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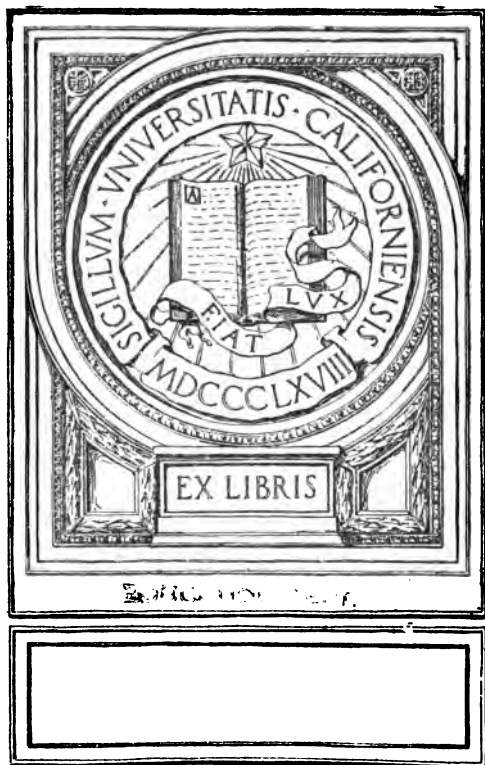
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THE SOUTHWORTH-STONE ARITHMETIC

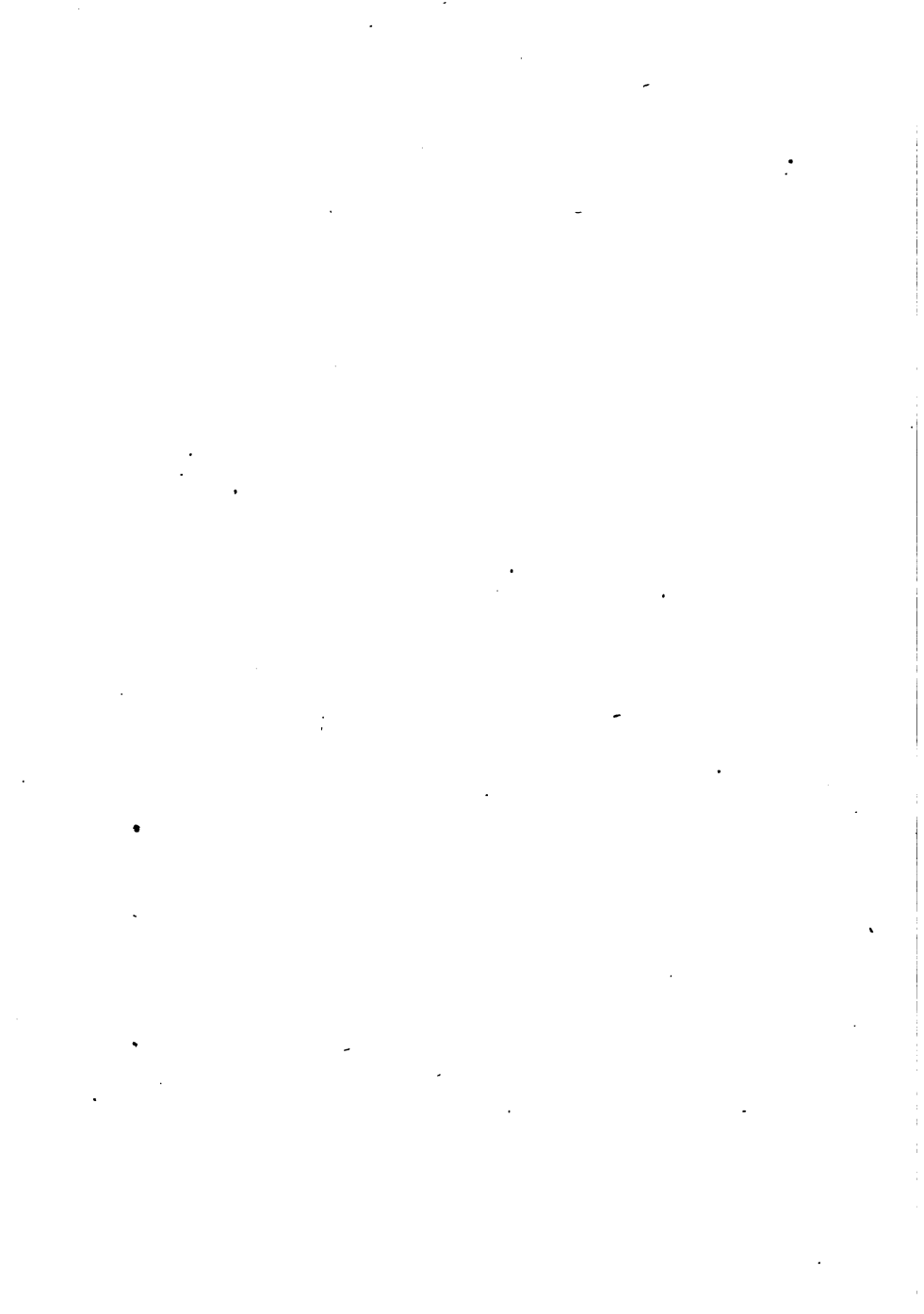
BOOK II

BENJ. H. SANBORN & Co.

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THE

UNIV. OF
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SOUTHWORTH-STONE ARITHMETIC

A RATIONAL METHOD

BOOK II. FOR INTERMEDIATE GRADES

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BENJ. H. SANBORN & CO.

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NEW YORK

CHICAGO

THE
SOUTHWORTH-STONE ARITHMETIC.

BOOK I. PRIMARY.

BOOK II. INTERMEDIATE.

BOOK III. ADVANCED.

WITH OR WITHOUT ANSWERS.

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PREFACE

"The Southworth-Stone Arithmetic" is a graded series of three Books each separated into two Parts. The series is designed to cover the work of all the elementary grades in which a text-book is commonly used, beginning with the third-year grade and ending with the last year below the high school.

The books have been prepared not by theorists to exploit their peculiar notions, but by teachers of long and successful experience. They follow the order of subjects and the lines of development established by the highest educational authorities.

No attempt has been made to follow the so-called "spiral plan," now decadent; each grade, however, thoroughly reviews and carries forward the work of the preceding grades, new topics being introduced in order to stimulate the interest of the student and to develop his power.

In the presentation of subjects the inductive method has been employed throughout in a way that calls for study and effort and secures that mathematical training that never comes by mechanical figuring and imitation. This logical development of subjects differentiates the series from mere books of problems.

To secure skill and proficiency in the more important subjects, abundant exercises for drill and practice have been provided. A profusion of oral and written problems is given in about equal proportion. The number to be used must depend upon the need of the student. It will be found that fewer problems carefully solved and logically analyzed will be more valuable than many mechanically performed.

Many subjects heretofore treated in arithmetics have been omitted as non-essential or beyond the legitimate work of the ele-

mentary schools. Enough has been given, however, to meet the demands of business and to furnish the requisite mental discipline.

The methods employed in all the books of the series have been tested in manuscript in the model or training classes in the State Normal College at Ypsilanti, Michigan. The authors acknowledge their indebtedness to Miss Abigail Roe and Miss Mary Steagall and other teachers in that institution for valuable suggestions growing out of such tests. Especial thanks are due to President L. H. Jones of the College, for his counsel as the work has progressed and for his aid in making the books worthy of adoption and use.

This **Second Book** of "The Southworth-Stone Arithmetic" Series is designed for the use of fifth and sixth year pupils in graded schools. It is arranged in two parts.

Part I presents the fundamental processes, the relations of numbers, common fractions, decimals, denominate numbers, and measurements, with many simple oral and written exercises and problems.

In **Part II** the same subjects are more fully treated by way of reviews and illustrated by more difficult exercises. Percentage and its simpler applications are added. Abundant review problems are furnished. The appendix contains definitions of all technical terms used, for reference and reviews. (See Index.)

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Parentheses are used to indicate coördinated or correlated subjects, or to show the purpose of the work covered by the main title.

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THE SOUTHWORTH-STONE ARITHMETIC

SECOND BOOK

PART I

NOTATION AND NUMERATION

Read the following numbers : —

1. 3426; 9873; 6432; 7093; 9073.
2. 3030; 9103; 7003; 8300; 8804.
3. Are larger numbers than these ever needed? For what?

Large numbers are separated into *groups of three figures each*, beginning at the right. The first three make *ones'* group, the next three *thousands'* group, and the next *millions'* group. The fourth group is *billions*, but such large numbers are seldom needed.

Each group is read as if it stood alone, and then the name of the group is added. Do not use *and* in reading whole numbers.

34,268,240 is read 34 million, 268 thousand, 240 (*ones*).

NOTE. The group name is not used in reading *ones*.

Our grain products in 1900 were as follows : —

- | | | |
|---------------|-------------------|------------------------|
| 4. Buckwheat, | 637,930 acres, | 9,566,966 bushels. |
| 5. Wheat, | 42,495,385 acres, | 522,229,505 bushels. |
| 6. Rye, | 1,591,352 acres, | 23,995,927 bushels. |
| 7. Oats, | 27,364,795 acres, | 809,125,989 bushels. |
| 8. Corn, | 83,320,872 acres, | 2,105,102,516 bushels. |

The reading of numbers written in figures is **numeration**.

1. In 235, what does the 5 stand for? The 3? The 2?
 $235 = 2 \text{ hundreds} + 3 \text{ ———} + \text{ ———}.$

2. What is the value of each figure in the following:—

385; 2963; 3063; 17842 ?

3. What is the value of each 5 in 555? Compare the value of each with the next one at the left.

4. How many *ones* make 1 *ten*? How many *tens* make 1 *hundred*?

5. The **units** in the first place at the right, or lowest **order**, are **ones**; the **units** in the second order are **tens**; the **units** in the third order are **hundreds**; those in the fourth order are **thousands**.

Since ten units of any order make one unit of the next higher order, our system of writing numbers is called a decimal system.

Decimal comes from a word meaning *ten*.

6. What does the zero show in each of the following:—

302; 1053; 260; 3078 ?

7. Could we write such numbers as three hundred six if we had no zero?

8. Write in figures twenty-five thousand, two hundred.

9. Write one hundred nine thousand, three hundred three.

10. Write six million, eighty-six thousand, forty-three.

11. Write seventy million, seven hundred seven thousand, three hundred nine.

12. Write one hundred nine million, forty-two thousand, three.

The writing of numbers in figures is **notation**.

NOTE. The following table is so arranged as to give the pupil abundant practice in adding at sight, 3, 4, 5, 6, or more digits. Add rows and columns of each square; of each oblong; add each full column *a*, *b*, *c*, etc., to *x*; add each row out to any column. The pupil should add by groups, especially the groups that make 10. Thus in column *a*, $8 + 2$, $7 + 3$, $6 + 4$, $8 + 2$. In adding this column say, 10, 20, 30, 40. In adding row 1 out to *h*, say 10, 20, 30, 36, first grouping those making 10, then coming back to the $3 + 3$.

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>	<i>j</i>	<i>k</i>	<i>l</i>	<i>m</i>	<i>n</i>	<i>o</i>	<i>p</i>	<i>q</i>	<i>r</i>	<i>s</i>	<i>t</i>	<i>u</i>	<i>v</i>	<i>w</i>	<i>x</i>
1.	2	8	3	3	9	6	4	1	7	5	2	8	6	3	9	7	4	1	5	7	8	6	9	7
2.	4	7	8	5	3	9	6	4	5	3	2	8	3	7	6	5	9	4	3	8	2	1	7	6
3.	8	4	9	6	7	3	8	9	5	4	6	7	3	9	7	8	6	5	4	2	9	3	7	8
4.	6	3	9	7	5	4	9	5	8	3	6	4	3	9	6	5	7	1	4	9	2	8	3	6
5.	3	4	8	7	3	6	7	4	9	8	3	2	4	5	9	8	4	3	7	6	8	9	9	8
6.	7	7	6	7	4	8	8	9	8	9	7	6	4	9	3	1	4	8	9	7	7	6	6	4
7.	2	4	5	9	8	5	4	7	2	3	6	4	5	5	8	7	6	9	3	8	6	4	9	1
8.	8	9	7	5	4	8	4	3	3	6	2	3	7	9	8	4	2	6	5	4	3	7	3	8

Written

Add :—

	1.	2.	3.	4.
<i>a.</i>	345	678	978	456
<i>b.</i>	235	789	894	634
<i>c.</i>	452	894	946	739
<i>d.</i>	523	946	678	465

5-8. Find the sum of each of the rows *a*, *b*, *c*, and *d*.

9. Add the 4 sums of the rows *a*, *b*, *c*, and *d*.

10. Add the 4 sums of the columns 1, 2, 3, and 4.

11. How do the sums in Exercises 9 and 10 compare?

Since each is the sum of all the numbers in the 4 exercises, they should be alike. This is a **check** on our work; that is, we feel more sure that the work is correct if we get the same result each way we add.

Add by columns and by rows and check as in Exercises 9 and 10 on page 3:—

1.	2.	3.	4.
457	432	445	454
544	324	389	894
326	749	748	976
<u>247</u>	<u>477</u>	<u>476</u>	<u>789</u>

Add and check the following by adding upwards and downwards:—

5.	6.	7.	8.
6731	6942	3792	4679
978	7678	9876	8946
6143	5134	5472	9478
927	7568	8946	8967
843	4520	6478	3654
<u>849</u>	<u>9624</u>	<u>3961</u>	<u>4678</u>

Oral

9. Give the difference between 100 and each of the following:—
88, 76, 64, 81, 67, 49, 51, 95, 87, 17, 38, 46.

10. Give the difference between each two consecutive numbers in Exercise 9.

11. Replace x with the proper number in the following:—

Minuend	48	x	36	x	32	48	54	x
Subtrahend	<u>16</u>	<u>16</u>	<u>x</u>	<u>17</u>	<u>18</u>	<u>x</u>	<u>x</u>	<u>26</u>
Remainder	x	34	18	24	x	63	19	15

12. What is the relation of the minuend to the sum of the subtrahend and remainder?

13. How will this fact give you a check for subtraction?

1. Count backwards by 6's from 100.
2. Count backwards from 97 by 8's; by 7's; by 9's.
3. Minuend = 48; remainder = 16; find subtrahend.
4. Remainder = 19; subtrahend = 31; find minuend.
5. What is \$10.00 less \$4.25?
6. From \$5.00 take \$2.75.
7. From 1000 take 250; take 375; take 500.
8. Count by 12's from 150 to 6.

Give differences as rapidly as possible at sight : —

9.

67	59	75	86	94	47	85	53	78	59	135	265	318	209
<u>30</u>	<u>40</u>	<u>60</u>	<u>50</u>	<u>71</u>	<u>32</u>	<u>53</u>	<u>23</u>	<u>36</u>	<u>48</u>	<u>80</u>	<u>95</u>	<u>78</u>	<u>90</u>
10.

1246	3721	4986	5478	3966	2791	4865	7983	8472
<u>300</u>	<u>600</u>	<u>880</u>	<u>5406</u>	<u>3900</u>	<u>2500</u>	<u>4105</u>	<u>6981</u>	<u>460</u>
11.

539	827	396	417	824	391	864	249	618	347	892	346
<u>408</u>	<u>325</u>	<u>190</u>	<u>95</u>	<u>704</u>	<u>270</u>	<u>453</u>	<u>127</u>	<u>93</u>	<u>86</u>	<u>95</u>	<u>150</u>

12. Subtract each one of the following numbers from 100, giving the remainder only, first by columns and then by lines : —

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>	<i>j</i>	<i>k</i>	<i>l</i>	<i>m</i>	<i>n</i>
<i>o</i>	11	88	44	74	52	70	36	13	60	75	37	48	31	87
<i>p</i>	35	61	82	14	81	33	22	65	42	53	15	59	69	47
<i>q</i>	83	30	23	57	89	43	95	29	90	32	84	26	37	16
<i>r</i>	20	81	73	63	21	94	56	99	17	93	41	66	58	51
<i>s</i>	92	19	63	45	96	18	50	46	76	49	71	62	27	85
<i>t</i>	64	75	24	90	34	39	78	38	80	25	97	54	98	40

13. Give the differences between any two numbers in the same line in adjacent columns.

Written Addition

- 14-18. Find the sum of each column on the next page.
19. Give the sum of the 14 sums of the columns in Exercise 12.

1. From 700 take 372.

$$\begin{array}{r} \text{WORK} \\ 700 = 600 + 90 + 10 \\ 372 = 300 + 70 + 2 \\ \hline 328 = 300 + 20 + 8 \end{array}$$

from which we take

and we have as the remainder

EXPLANATION. As there are no *ones* and no *tens* in the minuend, we change 1 of the 7 *hundreds* to 10 *tens*; we then change 1 of these 10 *tens* to 10 *ones*. The minuend then becomes

6 hundreds 9 tens 10 ones,

3 hundreds 7 tens 2 ones,

3 hundreds 2 tens 8 ones, or 328.

In practice we may simply say 2 from 10, 8; 7 from 9, 2; 3 from 6, 3. Remainder 328. To check the result, $328 + 372 = 700$.

2. $610 - 425$. 3. $500 - 137$. 4. $8120 - 3769$. 5. $9000 - 137$.

TO THE TEACHER. In the following exercise the pupil is to find the difference between numbers in the same line in two columns. Each direction furnishes 10 exercises. Thus Ex. 1 is $21987 - 8395$; Ex. 2 is $64153 - 2934$, and so on.

No. of Exercises Find the difference between the numbers in columns: —

1-10. <i>a</i> and <i>b</i> .	31-40. <i>d</i> and <i>e</i> .	61-70. <i>b</i> and <i>d</i> .
11-20. <i>b</i> and <i>c</i> .	41-50. <i>e</i> and <i>f</i> .	71-80. <i>c</i> and <i>e</i> .
21-30. <i>c</i> and <i>d</i> .	51-60. <i>a</i> and <i>c</i> .	81-90. <i>d</i> and <i>f</i> .

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>
1.	8395	21987	96374	349100	84795	34762
2.	2934	64153	34900	63280	239600	29788
3.	6249	82731	8237	49375	47327	39979
4.	3784	46832	6942	86000	23458	68394
5.	2936	92138	11875	39700	58320	72591
6.	4875	31629	46763	2718	60027	60000
7.	9489	4796	33932	9522	55575	84932
8.	6766	3794	46000	6831	63872	68370
9.	3984	18213	6400	15939	91187	4511
10.	9878	7695	8537	68397	64739	83721

1. If you have forgotten the product of $4 \times \$5$, how can you find it by addition?

2. Which number is to be added?

3. What number shows how many times the $\$5$ is to be written in the column to be added?

The number to be multiplied, or written in the column to be added, is the **multiplicand**.

The number showing how many times the multiplicand is to be taken is the **multiplier**.

The result of the multiplication is the **product**.

4. In $3 \times \$6$ which is the multiplicand? The multiplier? What is the product?

The multiplier is usually written first and the sign (\times) is read **times**: thus 5×6 ft. is read 5 times 6 ft. The sign is read **multiplied by**, when the multiplier is written after the multiplicand: thus $\$5 \times 6$ is read $\$5$ multiplied by 6. The first way is preferable.

5. Can $\$5$ times 6 mean anything? The multiplier cannot refer to *things*, as dollars, feet, men, etc., for it simply shows the *number of times* the multiplicand is —.

Numbers that are applied to things of any kind are **concrete**.

Numbers read without any reference to things are **abstract**.

6. The multiplier must always be an — number; the multiplicand may be a — or an — number.

7. Read the multiplicands in the following; the multipliers; the whole expression:—

7×5 ft.; 8 qt. $\times 8$; 15×8 yd.; 9 days $\times 4$.

8. The sum of twelve 8's is —; 10×15 hours = —.

9. When eggs are 20 cents a dozen 12 doz. will cost — \times — or —.

10. Multiplication is a shortened form of —.

1. Compare $20 \times 5 + 4 \times 5$, or $100 + 20$, with 24×5 .
2. Multiply \$32 by 24, or find $24 \times \$32$.

WORK

\$32 = Multiplicand.

24 = Multiplier.

- $4 \times \$32 = \128 = First partial product.
 $20 \times 32 = 640$ = Second partial product.
 $24 \times \$32 = \768 = Complete product.

EXPLANATION. Since
 $24 = 20 + 4$, we find $24 \times \$32$
 by finding $20 \times \$32 + 4 \times$
 $\$32$.

REMARK. In practice we omit the zero in the second partial product.

3. What will 75 chairs cost at \$3.25 each? What is the multiplier?

Always separate dollars from cents by the decimal point.

4. Find the cost of 24 tons of coal at \$7.75 a ton.
5. Find the cost of 17 tons of coal at \$6.95 and 38 cords of wood at \$4.85.

What will be the cost:—

- | | |
|--------------------------|-----------------------------------|
| 6. Of 19 tons at \$6.28? | 8. Of 93 bbl. of flour at \$4.75? |
| 7. Of 24 tons at \$7.64? | 9. Of 78 bbl. of flour at \$5.67? |

Multiply:—

How many are:—

Find the product of:—

- | | | |
|--------------------------|---------------------------|---------------------------|
| 10. $\$3.87 \times 42$. | 13. $\$9.87 \times 123$? | 16. $345 \times \$6.49$. |
| 11. $75 \times \$4.93$. | 14. $846 \times \$6.49$? | 17. $678 \times \$5.87$. |
| 12. $69 \times \$8.43$. | 15. $927 \times \$5.28$? | 18. $925 \times \$6.93$. |

Find the cost of the following articles:—

- | | |
|-------------------------------|----------------------------------|
| 19. 367 T. of hay at \$17.45. | 24. 975 lb. wool at \$0.36. |
| 20. 489 yd. cloth at 37¢. | 25. 642 cords of wood at \$6.98. |
| 21. 579 bbl. sugar at \$9.87. | 26. 438 T. of hay at \$18.64. |
| 22. 496 A. of land at \$4.89. | 27. 859 bu. potatoes at \$0.79. |
| 23. 965 T. of coal at \$6.87. | 28. 761 ft. granite at \$0.75 |

1. What number multiplied by 4 = 12 ?
2. Name two other numbers whose product is 12.
3. $? \times 3 = 18$; $2 \times ? = 18$; $2 \times ? = 20$; $? \times 4 = 20$.
4. Since the multiplier and multiplicand *make* the product, they are called **factors** of the product.
5. What is the product of the following factors: —
9 and 8; 15 and 6; 20 and 5; 25 and 3; 16 and 6 ?
6. If 3 is one factor of 21, what is the other ?
7. 12 is a factor of 60. Find the other factor.
8. Find the factors of 22; of 34; of 26; of 35.

What numbers smaller than 14 produce: —

- | | | |
|-----------------|------------------|---------------|
| 9. 28, 32, 33. | 13. 65, 66, 72. | 17. 108, 110. |
| 10. 35, 36, 39. | 14. 77, 78, 81. | 18. 117, 121. |
| 11. 42, 45, 48. | 15. 84, 88, 91. | 19. 130, 132. |
| 12. 49, 52, 54. | 16. 96, 99, 104. | 20. 143, 156. |
21. By what numbers is 24 *exactly* divisible ?
 22. Name all the numbers that will exactly divide 18.
 23. Name all that will exactly divide 36.
 24. Instead of saying that 36 will contain 2, 3, 4, 6, or 9, we say 36 is a **multiple** of these numbers. 14 is a multiple of what two numbers ?
 25. 35 is a multiple of — and —.
 26. Which of the following are multiples of 2 ? Of 3 ?
4, 5, 9, 12, 15, 18, 16, 24, 27, 32, 54, 39, 72.
 27. Beginning with 4, name all the multiples of 2 to 100.
 28. Name all multiples of 3 to 99; all multiples of 4 to 100.
 29. 38 is a multiple of what two factors ?
 30. Give the multiples of 5 to 200.
 31. $3 \times \$8 = \$$ —. Name two factors that make \$ 24

1. Only — factor of any product can be a — number.
2. The product is like the — factor.
3. $? \times \$8 = \56 ; $4 \times ? = 28$ ft.; $3 \times ? = 21$ in.
4. Name two factors of 45 bu.; of 63 tons.
5. 64 lbs. is made up of what two factors?
6. Name the 6 multiples of 8 to 48; name the 6 multiples of 12 to 72.
7. What two multiples are common to both 8 and 12?
8. What is the least one that is common; that is, what is the least number that will exactly contain both 8 and 12?
9. Which of the following are multiples of 5; of 6; of 8?
40, 42, 64, 120, 80, 150, 65.
10. Give the other factor of those which are multiples of 5; of those which are multiples of 6; of 8.
11. When we have given the product and one factor, how do we find the other?
12. The product is 121 ft.; one factor is 11. Find the other.
13. — $\times 9$ miles = 108 miles; $7 \times \text{—} = \$77$.

In division the **product** becomes the **dividend**.

The **known factor** becomes the **divisor**.

The other factor, when found, is the **quotient**.

14. If the *dividend* is 91 days and the *divisor* is 7 days, what is the quotient? If the divisor is 7, what is the quotient?
15. The dividend is 96¢. The divisor is 8. What is the quotient?
16. One factor is 12 feet. The product is 84 feet. What is the other factor?
17. Product = \$96. Multiplier = 8. Multiplicand = what?

1. Divide 8008 by 26.

WORK

$$\begin{array}{r}
 \$308 \\
 26 \overline{) \$8008} \\
 \underline{78} \\
 208 \\
 \underline{208} \\
 0
 \end{array}$$

REMARK. The partial dividend 20 is smaller than the divisor 26. So we put 0 in the quotient, annex 8 to the 20, and say 26 in 208, 8 times.

When the divisor is an abstract number it shows into how many equal parts the dividend is to be divided, and the quotient shows the size of each of these parts. Then $\frac{1}{26}$ of \$8008 = \$308.

2. 6432 ft. \div 96.

4. 5600 mi. \div 34.

3. 6400 yds. \div 84 yds.

5. 8476 \div 68.

6. One factor of \$475,000 is \$250. Find the other.

7. The product of two numbers is 100,000. One factor is 125. Find the other.

8. Product = \$1675. One factor = \$67. The other factor is what?

9. One factor is 197. The dividend is \$90,817. What is the other factor?

Divide and check each by finding the product of the divisor and quotient:—

10. 3,468 by 75.

15. 17,863 \div 121.

20. 864,371 by 426.

11. 7,923 by 64.

16. 19,831 \div 131.

21. 698,428 by 573.

12. 8,495 by 85.

17. 57,632 \div 143.

22. 386,471 by 648.

13. 3,048 by 54.

18. 28,931 \div 151.

23. 694,328 by 901.

14. 5,703 by 72.

19. 73,201 \div 173.

24. 846,792 by 837.

Find:—

25. $\frac{1}{8}$ of \$84,231.

27. $\frac{1}{88}$ of \$6491.

29. $\frac{1}{52}$ of \$8291.

26. $\frac{1}{28}$ of \$8546.

28. $\frac{1}{5}$ of \$84,329.

30. $\frac{1}{76}$ of \$162,944.

1. The difference between two numbers is 7190, and the less is 619. What is the greater?

2. The minuend is 85,917. and the remainder is 5867. What is the subtrahend?

3. In 1890 the population of Massachusetts was 2,238,942, and of New York 5,997,853. In 1900 the population of Massachusetts was 2,805,346, and of New York 7,268,012. By how much did New York's gain exceed that of Massachusetts in the ten years?

4. I spent \$ 4485 for cattle and horses, buying the same number of each. If I paid \$ 75 apiece for the horses and \$ 40. each for the cows, how many of each did I buy?

5. A certain number is contained 25 times in 18,975. What is the number?

6. The product of three numbers is 57,120. If the first is 140 and the second is 17, what is the third?

7. A dealer paid \$1013.70 for 218 tons of coal, and sold it for \$1667.70. How much did he gain per ton?

8. A man purchased 130 bbl. of flour at \$ 4.50 per barrel, and a number of barrels at \$ 4. He paid in all \$ 665. How many barrels of the cheaper quality did he buy?

9. Bought a field 600 ft. long and 413 ft. wide. What will it cost me to fence it at 23¢ per foot?

HINT. Two sides are 600 ft. each and two are 413 ft. each.

10. I sold 38 tons of hay at \$ 14 per ton, and took in exchange a number of young cattle at \$ 19 each? How many cattle did I get?

11. How many pounds does each horse draw when three horses are hauling $3\frac{1}{2}$ tons of coal?

1. Smith and Jones buy the following bill of goods of each other. What is the balance due, and which of them must pay it?

Smith buys of Jones: —

148 bbl. of lime at \$ 2.45.

64 loads of sand at \$ 2.75.

328 bbl. cement at \$ 1.27.

105 ft. drain pipe at 27 ¢.

Jones buys of Smith: —

36 T. hay at \$ 18.90.

45 bu. oats at 65 ¢.

1 express wagon at \$ 118.

25 shovels at 87 ¢.

2. The expenses of an excursion party of 7 gentlemen and 5 ladies were \$ 47.40. If the gentlemen paid the expenses of the trip, how much did each pay?

3. Bought 130 tons of coal at \$ 4.70 per ton, and sold it at \$ 6.50 per ton. How much did I make on the lot?

4. How many bushels of potatoes at 75 ¢ per bushel will it take to pay for 43 bu. turnips at 60 ¢ per bushel?

5. A man bought 116 cords of wood at \$ 5.25 per cord, and paid $\frac{1}{3}$ at time of purchase. He sold 18 cords at \$ 6.50 per cord, and made another payment. How much did he then owe?

6. A dealer paid \$ 110.60 for 140 yards of carpeting, and sold it at 95 ¢ per yard. In cutting, 11 yards were wasted. How much did he gain on the piece?

7. A man bought a farm of 128 acres at \$ 23 per acre, and gave in payment a team and wagon valued at \$ 375 and 23 head of cattle valued at \$ 38 each, and paid the remainder in cash. How much cash did he pay out?

8. Which is worth the more, and how much, a city house and lot valued at \$ 4850 and 7 vacant lots worth \$ 850, or a farm of 320 acres worth \$ 27 per acre?

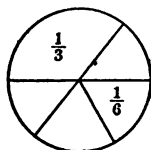
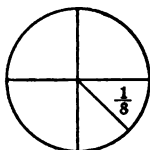
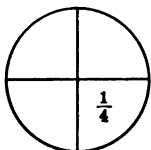
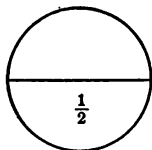
9. 12,000 inches — 318 yards = — feet.

1. How many quarts in 162 pints?
2. How many gallons in 48 quarts?
3. In 40 gills how many pints?
4. How many pints in 12 quarts and 1 pint?
5. How many bushels in 96 pecks?
6. In 15 bushels and 3 pecks how many pecks?
7. In 64 ounces how many pounds?
8. How many yards in 81 feet?
9. In 12 yards and 2 feet, how many feet?
10. How many hours in 180 minutes?
11. How many seconds in 3 minutes and 40 seconds?
12. How many pecks in 160 quarts?
13. In 108 inches how many feet? How many yards?

Written

14. How many hours in a week?
15. How many quarts in 28 bushels?
16. Change 464 quarts to gallons?
17. How many weeks in 175 school days?
18. How many yards in 629 feet?
19. How many inches in 128 yards?
20. How many ounces in 215 pounds?
21. Change 300 ounces to pounds and ounces.
22. Change 400 inches to feet and inches.
23. Change 1284 quarts to bushels and quarts.
24. Change 15 yards 18 inches to inches.
25. Change 784 minutes to hours and minutes.
26. How many gills in 34 quarts?

NOTE. The pupils are supposed to have had oral instruction in fractions in the lower grades. The fractions have been concrete, and the pupils know *fractional units* as objects, the same as *integral units*, and have counted, added, subtracted, multiplied, and divided them.



1. To get *one half* of a circle we divide it into — parts.
2. To get *one fourth* of a circle we divide it into — parts.
3. Compare $\frac{1}{2}$ of a circle and $\frac{1}{4}$ of it. $\frac{1}{2}$ of $\frac{1}{2}$ of a circle = — ;
 $\frac{1}{4} + \frac{1}{4} =$ —.

4. If each fourth be divided into 2 equal parts, the whole circle will be divided into how many equal parts?

5. What is each part called?

6. How many 8ths of a circle in $\frac{1}{4}$ of it? $\frac{1}{4} \div 2 = \frac{1}{8}$.

SUGGESTION. "Divided by 2" means divided into 2 equal parts.

7. 4 times $\frac{1}{8}$ of a circle = $\frac{1}{2}$ of it? $6 \times \frac{1}{8}$ of a circle = $\frac{3}{4}$ of it.

8. $\frac{1}{4} \div \frac{1}{8} =$ — ; $\frac{1}{2} \div \frac{1}{8} =$ —. 9. 1 circle — $\frac{3}{8}$ of it = $\frac{5}{8}$ of it.

10. How many $\$ \frac{1}{4}$ in a dollar? In $\$ \frac{1}{2}$?

11. $\$ \frac{1}{4} + \$ \frac{1}{2} = \$ \frac{3}{4}$. $\$ 1 - \$ \frac{1}{4} = \$ \frac{3}{4}$.

12. If you divide a circle into three equal parts, what is each part called? If you divide each of the 3 equal parts into 2 equal parts, what is each part called?

13. $\frac{1}{8} = \frac{1}{8}$. $\frac{1}{8} + \frac{1}{8} = \frac{2}{8}$ or $\frac{1}{4}$.

14. $\frac{1}{8}$ yd. = — in. ; $\frac{3}{8}$ yd. = — in.

15. $\frac{1}{8}$ bu. = — qt. ; $\frac{3}{8}$ bu. = — qt. ; $\frac{5}{8}$ bu. = — qt.

16. $\frac{1}{2}$ hr. = — min. ; $\frac{1}{4}$ hr. = — min. ; $\frac{3}{4}$ hr. = — min.

[illegible]

1. How many inches in a foot?
2. What part of a foot is here represented?
3. How many $\frac{1}{2}$ in. spaces in 1 in.? In 2 in.? In 3 in.? In 4 in.?
4. How many $\frac{1}{4}$ in. spaces in $\frac{1}{2}$ in.? In 1 in.? In 3 in.?
5. How many $\frac{1}{8}$ in. spaces in $\frac{1}{4}$ in.? In $\frac{1}{2}$ in.? In 1 in.? In 2 in.?
6. How many times is $\frac{1}{8}$ in. contained in $\frac{3}{4}$ in.? In $2\frac{1}{2}$ in.?
7. 6 times $\frac{1}{8}$ in. = $\frac{3}{4}$ in. 8 times $\frac{1}{4}$ in. = — in.
8. $1\frac{1}{2}$ in. + $1\frac{1}{2}$ in. = — in.; $2\frac{1}{2}$ in. + $1\frac{1}{4}$ in. = — in.
9. $\frac{1}{4}$ in. + $\frac{3}{8}$ in. = $\frac{5}{8}$ in.; $\frac{1}{4}$ in. + $\frac{1}{8}$ in. + $\frac{1}{2}$ in. = — in.
10. $1\frac{1}{4}$ in. + $\frac{3}{4}$ in. = — in.; $\frac{3}{4}$ in. + $\frac{1}{4}$ in. + $\frac{1}{8}$ in. = $\frac{7}{8}$ in.

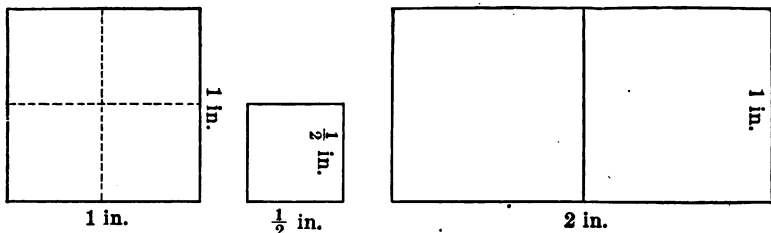
Add:—

- | 11. | 12. | 13. | 14. | 15. |
|--------|--------|--------|--------|--------|
| 1½ in. | 1¼ in. | ¾ in. | 1¼ in. | 1⅝ in. |
| 2¼ in. | 1⅜ in. | 1¼ in. | 2⅛ in. | 2⅜ in. |
| 3¼ in. | 2¼ in. | 2⅞ in. | 1⅞ in. | 4 in. |

16. $1\frac{3}{4}$ in. $- 1\frac{1}{2}$ in. = ____.
17. $\frac{5}{8}$ in. $- \frac{1}{4}$ in. = ____.
18. $\frac{1}{4}$ in. $- \frac{1}{8}$ in. = ____.
19. $\frac{3}{8}$ in. $- \frac{5}{8}$ in. = ____.
20. $\frac{6}{8}$ in. $- \frac{1}{2}$ in. = ____.
21. 2 in. $- 1\frac{1}{4}$ in. = ____.
22. 3 in. $- 2\frac{1}{8}$ in. = ____.
23. $3\frac{1}{4}$ in. $- 2\frac{1}{2}$ in. = ____.

24. Draw an oblong $2\frac{1}{2}$ inches long and $1\frac{1}{2}$ inches wide. What is the distance around it?

The distance around a closed figure, that is, the sum of the lines bounding a surface, is called the **perimeter**.



1. How many sides has a square ?
2. How do they compare in length ?
3. How many angles, or corners, has a square ?
4. How do they compare in size ?

The angles of a square are called **right angles**.

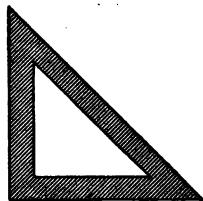
Flat surfaces with straight sides and right angles are called **rectangles**.

5. Are the figures at the top of the page rectangles? Which ones are squares ?

Rectangles that are not squares are **oblongs**.

6. The square at the left is called a **square inch**. Why ?

7. The small one is a *half-inch* square. How does a $\frac{1}{2}$ -inch square compare in size with an inch square or a square inch ?



Triangle for measuring right angles

8. How does the oblong compare in size with the square inch ?
9. Cut a 2-inch square from a paper. Fold it into square inches. How many does it contain ?
10. 3 half-inch squares are equal to what part of a square inch ?
11. Draw an oblong 1 inch wide and 3 inches long.
12. Into how many square inches can you divide it ?

Lines have one dimension, **length**.

Surfaces have two dimensions, **length** and **width** or **breadth**.

1. Find the product of the factors 203 and \$318. Which one must be multiplier? Why?

WORK

$\begin{array}{r} \$318 \\ 203 \\ \times 954 \\ \hline 63600 \\ \$64554 \end{array}$	<p>EXPLANATION. $203 = 200 + 3$; $203 \times \\$318 = 3 \times \\$318 + 200 \times \\$318$. $3 \times \\$318 = \\954; $200 \times \\$318 = \\63600. The sum of \$954 and \$63600 is \$64554. In practice we omit the zeros in the second partial product.</p>
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Find the product made by these factors:—

Select a multiplier such that you will have but two partial products when possible.

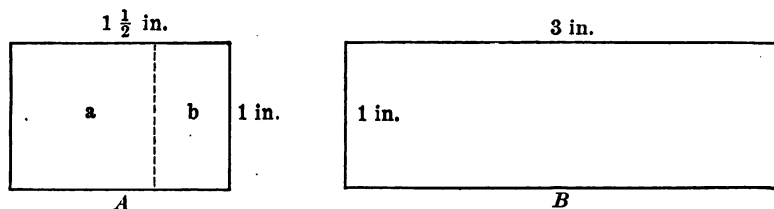
- | | | |
|-----------------------|------------------------|-------------------------|
| 2. 509×648 . | 9. 507×809 . | 16. 764×904 . |
| 3. 704×945 . | 10. 494×608 . | 17. 8701×906 . |
| 4. 907×893 . | 11. 904×889 . | 18. 9076×807 . |
| 5. 395×607 . | 12. 879×707 . | 19. 7809×703 . |
| 6. 809×694 . | 13. 609×984 . | 20. 3009×847 . |
| 7. 907×648 . | 14. 685×982 . | 21. 9070×369 . |
| 8. 876×394 . | 15. 809×698 . | 22. 8095×908 . |

Problems

1. A dealer bought 218 tons of coal at \$5.27 per ton, and sold the lot for \$1667.70. How much did he gain?

2. A dealer bought 209 barrels of flour at \$4.52 per barrel, and sold it for \$6.20 per barrel. What did he gain on the whole purchase?

3. A man after selling his stable sold 2 matched horses at \$225 each, 1 black horse at \$175, 2 bay horses at \$135 and \$160, 4 gray team horses at \$75 each, and 3 single carriages to a dealer at \$68 each. What did he receive for all?



1. What kind of figures are these?
2. The dotted line divides A into what kind of figures?
3. What is the size of a ? How does b compare with a ?
4. Compare B with a . How many square inches in B ?
5. Compare B with A . How many square inches in A ?
6. Draw a square 2 inches long. How many square inches in it? Should you call it a 2-inch square? Why?

We measure — in inches and feet.

We measure surfaces in square inches or square feet.

7. Draw a 3-inch square. Divide it into oblongs 1 inch wide and 3 inches long.
8. How many oblongs in the square?

9. How many square inches in each oblong?
10. Then how many square inches in the whole square?
11. Divide the square into square inches and count them.

The number of square inches in a surface is its **area**.

12. Find the area of an oblong 2 inches wide and 3 inches long. Draw the oblong and divide it into square inches.

13. Draw a 4-inch square and find its area.
14. What is the area of oblong A , at the top of the page?
15. What is the perimeter of A ?

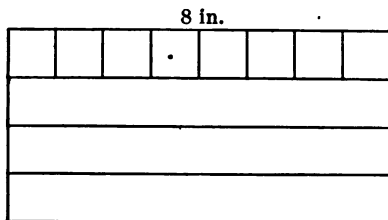
16. How many times will B contain $\frac{1}{2}$ of a square inch?

17. Find the area of an oblong $2\frac{1}{2}$ inches wide and 3 inches long. Divide into square inches and 3 oblongs $\frac{1}{2}$ inch by 1 inch.)

1. What is the difference between an inch and a square inch?
2. Inches are used in measuring —, and square inches are used in measuring —.
3. Draw an oblong 3 inches wide and 4 inches long.
4. Divide it into oblongs 1 inch wide and 4 inches long.
5. How many square inches in one of these oblongs?
6. How many square inches in the whole oblong?

Draw on a "scale of $\frac{1}{4}$," that is, represent an inch by $\frac{1}{4}$ of an inch, and find the area of rectangles with these dimensions:—

7. 8 inches long and 4 inches wide.



SUGGESTION. This may be divided into 4 strips 8 inches long and 1 inch wide, each containing — sq. in. The area then is equal to 4×8 sq. in., or 32 sq. in. In what other way could you have divided it?

Scale $\frac{1}{4}$

8. 12 in. long and 5 in. wide.
9. 9 in. long and 7 in. wide.
10. 16 in. long and 12 in. wide.
11. 10 in. long and 7 in. wide.
12. 12 in. long and 8 in. wide.
13. 18 in. long and 4 in. wide.
14. Find the area of a 12-inch square.
15. What may a 12-inch square be called?

A square foot = 144 square inches.

16. Find the area of a 3-foot square.
17. What may a 3-foot square be called?

A square yard = 9 square feet.

18. Find the area of a plot of ground 20 feet by 80 feet.
19. Find the area of a floor 8 yd. long and 6 yd. wide.

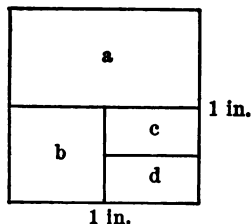
1. a is what part of a square inch?

2. b is what part? c is what part?

3. Compare $\frac{1}{2}$ sq. in. and $\frac{1}{4}$ sq. in.;
 $\frac{1}{4}$ sq. in. and $\frac{1}{8}$ sq. in.

4. If this square represents a piece of valuable metal worth \$24, what is a worth?

What is b worth? What is c worth?



5. $\frac{1}{8}$ sq. in. + $\frac{1}{8}$ sq. in. + $\frac{1}{4}$ sq. in. = $\frac{1}{2}$ sq. in.; $4 \times \frac{1}{8}$ sq. in. = —.

6. $\frac{1}{2}$ sq. in. + $\frac{1}{4}$ sq. in. = —. $\frac{1}{4}$ sq. in. + $\frac{1}{8}$ sq. in. = — times.

7. $\frac{1}{2} \div 2 = \text{—}$; $\frac{1}{4} \div 2 = \text{—}$; $\frac{1}{2} \div 4 = \text{—}$.

8. $\frac{3}{4} - \frac{1}{8} = \text{—}$; $\frac{1}{2} - \frac{3}{8} = \text{—}$; $\frac{1}{4} - \frac{1}{8} = \text{—}$; $1 - \frac{5}{8} = \text{—}$.

9. When I divide a square into 6 equal parts, what is each part called?

10. What are five of those parts called?

11. If I divide \$30 into 6 equal parts, what part of \$30 is each part?

12. Five of those parts are what part of \$30?

13. Find $\frac{2}{3}$ of \$42; $\frac{1}{3}$ of \$40; $\frac{2}{3}$ of 12 feet; $\frac{1}{3}$ of 12 inches.

14. Draw an oblong. Draw another $\frac{1}{2}$ as large; $\frac{2}{3}$ as large; $\frac{3}{4}$ as large.

15. 1 oz. is what part of a pound? 4 oz. is what part of a pound? 8 oz. is what part of a pound?

16. If a pound of butter costs 28¢, what will 4 oz. cost?

17. At 28¢ a pound what will 1 lb. 8 oz. cost?

18. At 12¢ a pound what will 1 lb. 8 oz. cost? What will 4 oz. cost? 1 lb. 12 oz. will cost what?

19. At 24¢ a yard what will 1 yd. 18 in. cost? What will 9 in. cost? 1 yd. 27 in. will cost what?

20. At 40¢ a bushel what will 1 bu. 3 pk. of potatoes cost?

1. $\frac{1}{3}$ of 36 inches is how many inches?
2. $\frac{2}{3}$ of 36 inches means what? $\frac{2}{3}$ of 36 inches = $2 \times$ — or —.
3. $\frac{1}{4}$ of 24 lb. = —; $\frac{3}{4}$ of 12 lb. = $3 \times$ — lb. or — pounds.

Find in like manner: —

- | | | |
|------------------------------|-------------------------------|-----------------------------|
| 4. $\frac{3}{4}$ of \$40. | 13. $\frac{2}{3}$ of 45 tons. | 22. $\frac{3}{4}$ of 56. |
| 5. $\frac{5}{8}$ of 30 ft. | 14. $\frac{3}{4}$ of 42 qt. | 23. $\frac{5}{12}$ of 108. |
| 6. $\frac{3}{7}$ of 28 mi. | 15. $\frac{2}{10}$ of \$70. | 24. $\frac{7}{12}$ of 144. |
| 7. $\frac{2}{5}$ of 45 lb. | 16. $\frac{7}{8}$ of \$72. | 25. $\frac{4}{11}$ of 121. |
| 8. $\frac{3}{8}$ of 24 oz. | 17. $\frac{2}{3}$ of \$33. | 26. $\frac{3}{4}$ of 400. |
| 9. $\frac{4}{5}$ of 27 doz. | 18. $\frac{4}{5}$ of 63 hr. | 27. $\frac{5}{8}$ of 600. |
| 10. $\frac{5}{7}$ of \$35. | 19. $\frac{4}{11}$ of \$66. | 28. $\frac{5}{8}$ of 270. |
| 11. $\frac{5}{8}$ of 48 yd. | 20. $\frac{7}{12}$ of 84 hr. | 29. $\frac{4}{7}$ of 350. |
| 12. $\frac{7}{8}$ of 63 gal. | 21. $\frac{4}{11}$ of \$44. | 30. $\frac{4}{11}$ of 1100. |
31. 5 is $\frac{1}{4}$ of what number?
 32. 8 is $\frac{1}{3}$ of what number?
 33. 8 is what part of 24? of 32? of 40?
 34. 20 min. is what part of an hour? 10 min. is what part?
 35. 12 oz. is what part of a pound?
 36. How many pounds in a ton? 1000 lb. is what part of a ton? 500 lb. is what part? 1500 lb. is what part?
 37. If butter is selling at 24¢ a pound, what will $\frac{1}{4}$ of a pound cost? what will $2\frac{1}{4}$ lb. cost?
 38. At 40¢ a pound what will 12 oz. of tea cost? (12 oz. = $\frac{3}{4}$ lb.)
 39. A boy sells $\frac{3}{4}$ of his papers and has 5 left. How many had he at first?
 40. If $\frac{1}{2}$ doz. oranges cost 20¢, what will 5 doz. cost?
 41. If 4 qt. of nuts cost 40¢, what will $\frac{1}{4}$ bu. cost?

1. A man pays \$300 a year rent. What should he pay for $\frac{7}{12}$ of a year? For $1\frac{5}{12}$ yr.?
2. Find the cost of $1\frac{3}{4}$ tons of coal at \$8.50 a ton.
3. A horse costs \$108. A buggy costs $\frac{7}{12}$ of this amount. Find the cost of the buggy.
4. I buy a horse for \$186. When I sell him I gain $\frac{1}{2}$ this amount. What do I gain? What is the selling price?
5. I spend $\frac{1}{3}$ of my salary for house rent. If my salary is \$1760, what is my house rent?
6. I spent \$3600 for a farm, which is 8 times as much as I spent for a house. What did I spend for both?
7. There are $16\frac{1}{2}$ feet in a rod. How many feet in 6 rods?
8. Draw an oblong $2\frac{1}{2}$ in. long and 2 in. wide. What is its perimeter?
9. What is the area of the oblong?
10. Draw a $2\frac{1}{2}$ inch square. Find its perimeter and area.
11. What part of a pound is 12 oz.? Find the cost of 5 lb. 12 oz of butter at 32¢ a pound.
12. What part of a ton is 1500 lb.?
13. A man saves $\frac{2}{3}$ of a yearly income of \$2000. How long will it take him to save \$4000?
14. What part of a square yard is a square foot? If a square yard of zinc costs \$1.35, what will 5 square feet cost?
15. What will it cost to fence a garden 3 rods long and 5 yards wide, at 75¢ a yard? A rod = $5\frac{1}{2}$ yards.
16. When a square foot is worth \$4.32, what are 28 square inches worth?

1. Subtract 8×7 from 5×13 .
2. Subtract the sum of 9 and 6 from their product.
3. Divide $23 + 13$ by $23 - 13$.
4. What number added to 19 will make $38 + 3 \times 5$?
5. A man earned \$65 and spent \$15 at one time and \$7 at another; how much had he then left?
6. How many times $\frac{1}{3}$ of 15 in 3×15 ? In 3×13 ?
7. A boy found a quarter and earned 20 cents. How many bunches of firecrackers could he buy at 15¢ a bunch?
8. Dick had 35 postage stamps. He gave his friend 15, lost $\frac{1}{4}$ of the remainder, and sold what he then had at the rate of 3 for 1¢. How much did he receive?
9. 18 days' board, at $\$3\frac{1}{2}$ per week, will cost how many dollars?
HINT. What was the price of board for a day?
10. The divisor is 6, the remainder 5, and the quotient 9. What is the dividend?
11. We buy milk at 7¢ per quart, except Saturday, when we take 2 quarts instead of one. What is our weekly milk bill?
12. If a man pays \$17 for 4 weeks' board, how much will he pay in 12 weeks? (12 is how many times 4?)
13. If 15 men can make a walk in 6 days, how long will it take 1 man to build it alone?
14. What will 5 bushels of potatoes cost at 30¢ per peck?
15. If 7 barrels of apples are worth \$21, how much are 9 barrels worth?
16. A tank can be filled in 14 minutes by 5 pipes. How long will it take 1 pipe to fill it? How long will it take 7?

1. If you should write 978 on your slate or paper 86 times, and find the sum, what would it be?

2. If the product of two numbers is 2464 and one is 28, what is the other?

3. A man's income is \$160 a month; his expenses are \$856 per year. What can he save in a year?

4. What must you add to the sum of the smaller of these two columns to make it equal the larger?

\$ 346.94

276.31

1186.95

\$732.98

763.25

89.94

5. A man who has 11,645 pounds of coal to put into a bin uses a basket holding 85 pounds. How many basketfuls does he carry?

6. A farmer sells his apples at \$1.25 a barrel. If he pays 15¢ a barrel for picking and 20¢ for the barrel, how much does he make on 75 barrels?

7. A trader counts the money he has received during the day, and finds he has 208 half-dollars, 73 quarters, 118 dimes, 42 nickels, and 13 cents. How much has he received in all?

8. A lot of land is 150 ft. long and 50 ft. wide. Draw an oblong 3 in. by 1 in. to represent it. How many feet of wire shall I need to surround it three times?

9. Ten thousand pounds of flour will fill how many barrels, if 196 pounds are put into each barrel?

10. Lawrence's father allows him \$1.50 a month for spending money. How long will it be before he can buy a printing press that costs \$36?

11. How many 4-ounce packages in 96 pounds?

1. Which would you choose, $\frac{7}{8}$ of \$3464 or $\frac{3}{4}$ of \$3828?
2. What is the area of a rug 3 yards wide and 4 yards long?
3. If the rug in Ex. 2 cost \$30, what was that per square yard? At this rate, what should I pay for a rug 2 yd. by $1\frac{1}{2}$ yd.?
4. I bought 375 acres and sold $\frac{3}{4}$ of it. How much did I keep? (How many $\frac{1}{4}$'s did I keep?)
5. Frank's kite string is 376 feet long, and Tom's $\frac{3}{4}$ as long. What is the length of Tom's?
6. There are 196 lb. of flour in a barrel. How many ounces are there?
7. A man had 7380 acres of land and sold 1476 acres. What part of his land did he sell? ($7380 \div 1476 = \text{what?}$)
8. One basket contains 548 apples, and another $\frac{3}{4}$ as many. How many in both?
9. Mr. Smith owns 640 acres of land, and Mr. Lee owns $1\frac{1}{8}$ as much. How much more has Mr. Smith than Mr. Lee?
10. A man's farm is in the shape of an oblong 80 rods wide and 120 rods long. How many square rods has he?
11. There are 160 square rods in an acre. How many acres in the farm described in Ex. 10?
12. There are 927 oranges in one pile and $\frac{7}{8}$ as many in another. How many more in the larger pile?
13. A man paid \$300 for a horse, $\frac{4}{5}$ as much for a buggy, and $\frac{1}{15}$ as much for a harness. What did he pay for all?
14. Bought a house for \$3875; paid \$350 for painting, \$225 for lighting and heating, and \$179 for grading around the house. How much was the whole cost?

1. If you sleep $\frac{1}{8}$ of your time, how many hours do you sleep in a week?
2. When brooms are 25¢ each, how many can you buy for \$3?
3. Dr. French pays \$2½ a month for his telephone. What does it cost him per year?
4. James buys a bicycle for \$75, agreeing to pay \$11 down and \$8 a month afterwards. How long before he will have paid all he owes?
5. A trader bought a bunch of 100 bananas for \$4, and sold them for 5¢ each. How much did he gain?
6. A newsboy sells 10 papers daily. If he makes $\frac{1}{2}$ a cent on each, what does he earn in a week?
7. At \$1.60 a gallon, what will 3 pints of oysters cost?
8. At \$10 a ton, what will 1000 lb. cost? What will 500 lb. cost?
9. How many yards around a room 15 ft. long and 12 ft. wide? Find the area of the floor.
10. How much will 3 gal. and 1 qt. of milk cost at 20 cents a gallon?
11. How many square inches of glass in a window pane 10 in. by 14 in.?
12. If 3 qt. of nuts cost 18¢, what will $\frac{1}{2}$ a bushel cost?
13. How many feet in 100 inches?
14. How many minutes in $1\frac{1}{2}$ hours?
15. Draw an oblong to show that $\frac{3}{4} = \frac{6}{8}$.
16. Show by a drawing that $\frac{1}{2}$ of $\frac{1}{3}$ is $\frac{1}{6}$.
17. Take $\frac{2}{3}$ of 24 from $\frac{1}{3}$ of 90.
18. Show by an oblong that $\frac{1}{3} = \frac{2}{6}$.
19. Show also that $\frac{1}{3}$ of $\frac{1}{5} = \frac{1}{15}$.

1. I bought some land for \$950 and sold it for $\frac{2}{3}$ more than I paid for it. Find the selling price.

2. Last year a farmer raised 396 bushels of beans, 198 bushels of potatoes, and 916 bushels of wheat. His crop of corn was $\frac{2}{3}$ as many bushels as the sum of the other three. How many bushels of corn did he raise?

3. How many 8-quart bags will it take to hold 395 bushels?

4. I sold a quantity of flour for \$756 and gained \$64. What did the flour cost me?

5. How many square feet in my garden, 189 feet long and 63 feet wide?

6. Into how many beds 9 feet square can I divide this garden?

7. What is the cost of a marble slab 4 feet by 2 feet at \$2.75 per square foot?

8. I have a city lot 60 feet by 24 feet. What is it worth at \$0.38 per square foot?

9. Find $\frac{7}{12}$ of \$5472 and add to $\frac{5}{8}$ of \$1386.

10. I bought a farm of 45 acres for \$2250 and sold it for \$2430. What did I gain per acre?

11. I bought 320 acres of land for \$12,380 and sold $\frac{9}{16}$ of it at \$62 per acre. How many acres had I left and what did the remainder really cost me?

12. I have 3 bins that will hold 32 bushels each and 2 others that will together hold $\frac{2}{3}$ as much as the first three. How much wheat can I store in all 5 bins?

13. From $\frac{3}{4}$ of 9872 feet subtract $\frac{7}{8}$ of 2763 feet.

14. Multiply $\frac{2}{7}$ of 2842 by $\frac{5}{8}$ of 372.

1. Compare 1 pint and 2 quarts. If two quarts of beans cost 16¢, what will 1 pint cost?

2. 12 is $\frac{1}{2}$ of —; 12 is $\frac{1}{3}$ of —; 12 is $\frac{1}{7}$ of 48.

3. 6 is $\frac{1}{3}$ of —; 6 is $\frac{1}{7}$ of 24; 6 is $\frac{1}{7}$ of 42.

4. Compare each of the following with 24:—

8, 6, 4, 3, 2. SUGGESTION. 24 is 3×8 ; 8 is $\frac{1}{3}$ of 24.

5. 6 is $\frac{1}{3}$ of —; 12 is $\frac{2}{3}$ of —; 16 is — of 24.

6. What part of 20 is 15? Of 25 is 10?

7. Compare each of these numbers with 36:—

6, 4, 3, 9, 18, 12, 2.

8. 6 is $\frac{2}{3}$ of what number?

9. If $\frac{2}{3}$ of some number is 12, what is $\frac{1}{3}$ of that number?

10. If $\frac{1}{5}$ of a number is 4, what is the number?

11. After spending $\frac{3}{8}$ of my money, how many 8ths are left?

12. After spending $\frac{3}{8}$ of my money, I have 40¢ left. How much had I at first?

13. Make an oblong to show that if $\frac{2}{3}$ of a thing were taken away $\frac{1}{3}$ of it would remain.

14. If $\frac{1}{4}$ of an acre costs \$ 20, what will 3 acres cost?

HINT. How many 4ths in 3?

15. Draw 3 circles and show that there are 12 fourths in 3.

16. Compare $\frac{3}{4}$ and $\frac{1}{2}$. If $\frac{3}{4}$ of an acre costs \$ 30, what will $\frac{1}{2}$ acre cost?

17. Compare $\frac{1}{4}$ and $\frac{1}{8}$. When $\frac{1}{8}$ of a cord of wood is worth \$ 1.50, what is $\frac{1}{4}$ of a cord worth?

18. Compare $2\frac{1}{2}$ with 5. When 5 pounds of tea are worth \$ 2.50, what are $2\frac{1}{2}$ pounds worth?

19. Compare $\frac{2}{3}$ and $\frac{3}{12}$; $\frac{2}{3}$ and $\frac{8}{12}$; $1\frac{1}{2}$ and $3\frac{1}{2}$.

1. When 6 barrels of flour cost \$31.68, what will 48 barrels cost?

WORK

$$48 = 8 \text{ times } 6.$$

$$\$31.68 = \text{cost of 6 barrels.}$$

$$8$$

$$\underline{\$253.44} = \text{cost of 48 barrels.}$$

2. What shall I pay for 75 pairs of shoes if 3 pairs cost \$11.25?

3. 4 tons cost \$22.40. Find the cost of 60 tons.

4. When 9 bushels of potatoes cost \$6.75, what shall I pay for 35 bushels?

WORK

$$9) \$6.75 = \text{cost of 9 bu.}$$

$$\underline{\$0.75} = \text{cost of 1 bu.}$$

$$35$$

$$\underline{3.75}$$

$$22.5$$

$$\underline{\$26.25} = \text{cost of 35 bu.}$$

5. If 7 barrels of apples cost \$15.75, what shall I pay for 19 barrels?

6. Could you have solved the first 3 exercises as you did Exercises 4 and 5? Which is shorter? Had Exercise 5 required the cost of 35 barrels, which method would you have used? Why?

7. If I travel 1728 miles in 8 days, how far shall I travel in 12 days at the same rate?

8. A steamer burns 453 tons of coal in 3 days. How many days will 1547 tons last her?

9. If 8 barrels of apples sell for \$9.73, what will 275 barrels sell for?

10. How many square inches of glass will cover a picture 12 in. wide and 16 in. long? Draw a diagram on a scale of $\frac{1}{4}$.

11. A farmer sold 18 barrels of potatoes, each holding $2\frac{1}{4}$ bushels, at \$0.75 a bushel. What did he receive?

12. I sold 18 head of cattle for \$378. At this rate, what should I get for 35?

13. At the same rate, what should I get for 36? Work in a short way.

1. How will the cost of 6 bu. compare with the cost of 24 bu. ? When 24 bu. of apples are worth \$60, what should I pay for 6 bu. ?
2. When 6 bu. are worth \$18.50, what should I pay for 24 bu. ?
3. Compare 7 with 21. When 21 acres of land sell for \$3240, what are 7 acres worth at the same rate ?
4. When 7 tons of coal cost \$65, what must one pay for 21 tons ?
5. When 13 head of horses sell for \$4030, what is that per head ? At this rate, what should I get for 4 ?
6. John sells 12 bu. of nuts for \$7.50. What should Henry get for 36 bu. ?
7. Compare 56 with 14. If a train runs 635 miles in 14 hours, how far will it run in 56 hours at the same rate ?
8. If a train runs 387 miles in 9 hours, what is the rate per hour ? At this rate, how far will it run in 23 hours ?
9. Compare 17 and 34. When 34 cords of wood sell for \$186, what should you pay for 17 cords ?
10. When 17 tons of hay are worth \$210.50, what should a farmer get for his crop of 34 tons ?
11. Compare 14 and 42. When 42 acres produce 1648 bu. of wheat, what will 14 acres produce at the same rate ?
12. If a man earns \$980 in 14 months, what can he earn in 42 months at the same rate ? Solve this in two ways.
13. Compare 8 with 24. When 8 cords of wood last a family 148 days, how long ought 24 cords to last ?
14. If my rent for 3 months is \$186, what will it be for a year ?
15. My gas bill averages \$9.27 per quarter. What will it amount to in $3\frac{1}{2}$ yr. ?

1. Compare 30 and 3; 40 and 4; 50 and 5.
2. $10 \times 6 = \text{---}$; 10×7 ; 10×8 ; 10×9 .
3. Compare 200 and 2. 300 and 3.
4. Annexing a zero to an integer multiplies it by what?
5. Annexing 2 zeros multiplies an integer by what?

Multiply:—

- | | | |
|----------------|-----------------|-----------------|
| 6. 25 by 100. | 9. 325 by 1000. | 12. 243 by 100. |
| 7. 35 by 1000. | 10. 172 by 100. | 13. 26 by 1000. |
| 8. 175 by 100. | 11. 846 by 100. | 14. 185 by 100. |
15. Cutting off a zero from 80 divides 80 by what?
 16. Cutting off 2 zeros from 800 divides it by what?

Divide:—

- | | | |
|------------------|---------------------|------------------|
| 17. 3400 by 100. | 19. 3500 by 100. | 21. 9000 by 100. |
| 18. 260 by 10. | 20. 14,000 by 1000. | 22. 8400 by 10. |
23. How many gold watches will \$5000 buy at \$100 each?
 24. 1000 boxes weigh 30,000 lb. What does 1 box weigh?
 25. How many times is 2 contained in 8?
 26. How many times is 20 contained in 80?
 27. Compare $90 \div 30$ and $9 \div 3$.
 28. Compare $400 \div 200$ and $4 \div 2$.
 29. Does dropping the same number of zeros from both dividend and divisor change the quotient?
 30. Divide 240 by 80.

(SUGGESTION. Dropping a zero from dividend and divisor, we have $24 \div 8 = 3$.)

In the same way divide:—

- | | | |
|------------------|-----------------------|---------------------|
| 31. 5600 by 800. | 33. 75,000 by 15,000. | 35. 96,000 by 8000. |
| 32. 1500 by 500. | 34. 14,400 by 1200. | 36. 7200 by 900. |

1. How many town lots will \$ 14,400 pay for at \$ 600 each ?
2. If 70 horses are sold for \$ 15,400, what is one sold for ?
3. At \$ 120 each, how many carriages may be bought for \$ 9600 ?
4. I paid \$ 64,800 for a number of building lots at \$ 600 each. How many did I buy ?

Divide:—

5. 6510 by 70. 7. 28,800 by 400. 9. 42,000 by 700.
6. 5940 by 90. 8. \$ 9600 by \$ 320. 10. 156,000 by 1300.
11. How many dollars and cents in $\frac{1}{4}$ of \$ 91 ?

- WORK** **REMARK.** When the dividend is dollars and the quotient is to contain cents, two zeros must fill the place of cents in the dividend. If the quotient is to contain mills or to be given in the nearest cent, three zeros must be added.
- 4) $\begin{array}{r} \$ 91.00 \\ \$ 22.75 \end{array}$

Divide, giving the quotient in dollars and cents:—

12. \$ 375 by 62. 14. \$ 725 by 83. 16. \$ 8493 by 219.
13. \$ 350 by 69. 15. \$ 2275 by 78. 17. \$ 629 by 57.
18. When balls are \$ 14 a dozen, one ball will cost $\frac{1}{4}$ of \$ 14.000, or \$ 1.166+. What shall I have to pay ?
19. What will a merchant have to pay for 1 hat, if hats are sold for \$ 32 a dozen ?

Divide, giving the quotient to the nearest cent:—

20. \$ 721 by 36. 23. \$ 647 by 217. 26. \$ 82.95 by 19.
21. \$ 849 by 87. 24. \$ 1486 by 625. 27. \$ 17.28 by 281.
22. \$ 946 by 73. 25. \$ 7034 by 154. 28. \$ 23.64 by 113.
29. I paid \$ 98.40 for 47 sheep. Find the cost of one.
30. I paid \$ 4000 for a farm of 158 acres. What was that an acre to the nearest cent ?

1. How many dimes in \$1? In 60¢? In 80¢?
2. How many 2-cent stamps will \$1 buy?
3. How many 5-cent stamps? How many 4-cent stamps?
4. How many 25-cent pieces in \$5? In \$4?
5. If you earn 30 cents a day, how long will it take you to earn \$2.10?
6. At 15 cents each, how many may be bought for \$1.50?
7. \$1.50 = how many cents? \$3.15 = — cents.
8. \$2 = — cents; \$4 = — cents; \$5.20 = — cents.

Written

9. At \$1.25 each, how many books can I buy for \$10?

WORK

\$1.25) \$10.00

or

125¢) 1000¢ (8 times
 1000

Therefore \$10 will buy
 8 books at \$1.25 each.

SUGGESTION. When the divisor contains cents it is better to change both dividend and divisor to cents before dividing.

Since the quotient is not cents, but a number denoting the number of times the cents in the divisor is contained in the cents in the dividend, it may be written at the right instead of above the dividend.

10. Divide \$17.28 by 36¢.
11. Divide \$96.75 by \$2.25.
12. Divide \$17.10 by 38¢.
13. Divide \$101.25 by \$3.75.
14. How many pounds of tea can I buy for \$21 at 75¢ a pound?
15. If starch is 8¢ a pound, how much can be bought for \$10?
16. My coal bill at \$5.75 per ton is \$69. How many tons did I buy?
17. At \$1.25 per bushel, how many bushels will \$100 buy?
18. At \$6.25 per cord, how much wood will \$112.50 buy?
19. I paid \$4.55 for tea at 35¢ per pound. How much did I buy?

1. Read \$3.75 as dollars, dimes, and cents.
2. A dime is what part of a dollar? The number that represents dimes or — of a dollar is written at the — of dollars.
3. A cent is what part of a dime? The number that represents cents or — of a dime is written at the — of dimes.
4. Read \$0.12½ as cents.

Our smallest coin is 1 cent, but we often speak of parts of a cent in quoting prices. $\frac{1}{10}$ of a cent is called a *mill*.

5. How many mills in 1¢? In ½ of a cent?
6. Read \$0.12½ as cents and mills.

Just as dimes, being 10ths of a dollar, are written at the right of dollars; and cents, being 10ths of a dime, are written at the right of dimes; so mills, being 10ths of a cent, are written at the right of cents. Dollars' place may be filled with a zero.

7. \$0.12½ may be written \$0.125. Write in this way \$0.37½.

Written

8. Find the cost of 37 yards of ribbon at \$0.62½ a yard.

WORK \$0.625 <u>37</u> 4.375 18.75 \$23.125	SUGGESTION. Write ½¢ as 5 mills. The right-hand place in the product will be mills, and the next two, cents. As we have no coins smaller than one cent, the one paying the bill will pay \$23.13. In business, final <i>results</i> are always given to the nearest cent, 5 mills or more counting as another cent. Answers in this book conform to this custom.
---	---

Find the cost of the following: —

- | | |
|-------------------------|----------------------------|
| 9. 23 yd. at \$1.37½. | 11. 67 cords at \$3.47½. |
| 10. 19 gal. at \$4.62½. | 12. 49 barrels at \$2.87½. |

1. At \$2.75 each, how many books may be bought for \$50, and how much money will be left?

2. What will 3500 pounds of coal cost at \$8 a ton?

3. How many 4 oz. packages can be made from 179 pounds?

4. Find the number of square feet in a floor 12 ft. wide and $15\frac{1}{2}$ ft. long. Let $\frac{1}{2}$ inch represent 1 foot, and draw a figure.

Find the amount of the following purchases: —

5. 29 bars soap @ 7¢.

6. 25 cans condensed milk @ 17¢.

17 pkg. soapine @ 19¢.

27 lb. chocolate @ 37¢.

35 lb. borax @ 18¢.

18 tins Dutch cocoa @ 59¢.

7. Add $\frac{3}{4}$ of 488 to $\frac{2}{3}$ of 720.

9. Add $\frac{3}{4}$ of 3786 to $\frac{1}{4}$ of 5000.

8. From $\frac{3}{4}$ of 952 take $\frac{2}{3}$ of 728.

10. Find $\frac{1}{3}$ of \$4950.

11. A newsdealer buys 36 papers @ 4¢, 25 magazines @ 7¢, and 13 magazines @ 28¢. He gains \$2 when he sells them. What does he receive for the lot?

12. There are 64 squares on a checkerboard. The board is as long as it is wide. Each square is $1\frac{1}{2}$ inches long. How wide is the board?

13. How many square feet in a town lot 72 ft. by 120 ft.?

14. What is the lot worth at $37\frac{1}{2}$ ¢ per square foot?

Find the cost of: —

15. 12 bu. potatoes @ \$0.87 $\frac{1}{2}$.

16. 12 $\frac{1}{2}$ lb. meat @ 14¢.

1 $\frac{1}{2}$ bu. beans @ \$1.80.

8 lb. lard @ 12 $\frac{1}{2}$ ¢.

3 $\frac{1}{2}$ bbl. apples @ \$2.20.

4 lb. butter @ 32 $\frac{1}{2}$ ¢.

17. What is a building lot 60 feet by 84 feet worth at \$0.36 per square foot?

1. $4\frac{1}{2} \times \$2.80$ means $4 \times \$2.80 + \frac{1}{2}$ of $\$2.80$. Find it.
2. Find the cost of $13\frac{3}{4}$ bushels of apples at 95¢ per bushel.
3. Find the cost of:—

21 $\frac{1}{2}$ yards silk at \$1.20.

26 $\frac{1}{4}$ yards percale at 16¢.

2 $\frac{7}{8}$ yards velvet at \$2.80.

4. How much larger is $3\frac{1}{4} \times 184$ than $1\frac{7}{8} \times 224$?
5. A woman exchanged 18 dozen eggs at 21 $\frac{1}{2}$ cents per dozen for 13 lb. rice at 9¢ and coffee at 30¢ per pound. How many pounds did she buy?
6. On a certain map an inch represents 20 miles, hence a square inch represents a 20-mile square of country. How many square miles represented on the map if it measures 4 by 6 inches?

Find the cost of the following:—

7. 35,000 ft. lumber at \$23 per M.

SUGGESTION. "Per M" means per 1000; since 35,000 is 35×1000 , we have $35 \times \$23 =$ —.

8. 175,000 brick at \$9.75 per M.
10. 18,500 brick at \$10.80.
9. 47,000 ft. at \$42.75 per M.
11. 97,500 shingles at \$18.75.
12. Bought at an auction 2 wagons for \$125, a plow for \$35, a horse for \$125, a yoke of oxen for \$250. Paid $\frac{2}{3}$ of the amount at the time of purchase, and $\frac{1}{3}$ a month later. How much had I yet to pay?
13. If I pay 80¢ per cord to have 4-foot wood sawed into 16-inch pieces, what should I pay to have it sawed into 12-inch pieces?
14. If a tank will hold 250 gallons and is $\frac{2}{3}$ full, what is left after 85 gallons are drawn off?

1. What is one of the four equal parts of a dollar called?
2. What is meant by $\frac{1}{4}$ of an apple? $\frac{3}{4}$ of an apple?
3. Draw a circle and divide it into 4ths. How many 4ths in the whole circle?
4. Divide each 4th into two equal parts. What is each part called?
5. $\frac{1}{4}$ of the circle is equal to how many 8ths?
6. Compare $\frac{1}{4}$ of a circle with $\frac{1}{8}$ of it. Compare $\frac{1}{2}$ and $\frac{1}{4}$.
7. If you measure a line by a yardstick you express the measure in what?
8. The length of a line measured by a foot rule is given in what?
A yard or a foot, when used to measure some line, is called the **measuring unit**, or the **unit of measure**.
9. When you measure a circle, or a part of a circle, in 4ths, what is your *unit of measure*?
10. Which is the larger unit, $\frac{1}{2}$ or $\frac{1}{4}$?
11. When you change 4ths to 8ths, do you change to a larger or smaller unit?
12. Which is larger, $\frac{3}{4}$ or $\frac{3}{8}$? What is the unit of measure in each?
13. Draw an oblong to show that $\frac{1}{2} = \frac{4}{8}$; that $\frac{1}{2} = \frac{3}{6}$.
The two numbers needed to express a fraction are called its **terms**.
14. Draw an oblong and represent $\frac{6}{12}$. Which term shows the number of parts into which the oblong was divided? Which term shows the *name* of these parts?
15. Which term shows the *number* of parts in the fraction?

1. Cut a strip of paper 1 foot long into pieces 1 inch long. How many pieces have you? What part of a foot is each?

2. What is meant by $\frac{3}{12}$ of a foot?

3. What does the 12 show? What does the 3 show?

4. In the fraction $\frac{5}{8}$ of a gallon, tell what each term shows.

The lower term shows into **how many parts** the whole has been divided, and hence **names the fractional unit**, or the equal parts in the fraction; it is called the **Denominator**.

The upper term shows the **number of fractional units** in the fraction, and is called the **Numerator**.

5. In what respect are 3 feet and 9 feet alike?

6. In what respect are $\frac{7}{12}$ of a foot and $\frac{5}{12}$ of a foot alike?

Like numbers have units of the same *name* and *size*.

7. Add 1 inch, 2 inches, and 4 inches.

8. Add $\frac{1}{12}$ ft., $\frac{2}{12}$ ft., and $\frac{4}{12}$ ft.

9. $\frac{1}{8} + \frac{1}{4} = \frac{1}{12} + \frac{3}{12} = \frac{4}{12}$. $\frac{1}{12}$ and $\frac{3}{12}$ are *like* fractions because their **—tors** are alike, that is, they have units of the same name and size.

10. Find the *like* numbers in the following and tell why they are alike:—

3 ft., \$6, $\frac{2}{3}$ ft., 6 ft., $\frac{1}{4}$, $\frac{1}{8}$ ft., 7 ft., $\frac{3}{4}$.

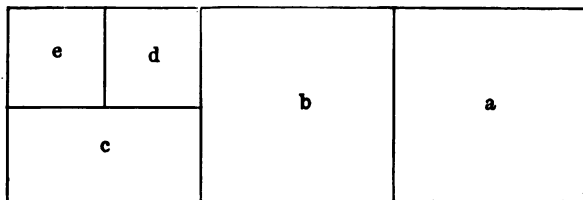
11. $\frac{3}{4}$ of a foot = — inches; $\frac{3}{4}$ of a foot = — inches.

12. Compare $\frac{3}{4}$ and $\frac{9}{12}$.

13. Compare $\frac{5}{8}$ and $\frac{10}{12}$.

14. $\frac{1}{2}$ ft. = — in.; $\frac{5}{8}$ ft. = — in.; $\frac{10}{12}$ ft. = — in.

15. $\frac{3}{4}$ yd. = — in.; $\frac{2}{3}$ yd. = — in.; $\frac{2}{3}$ yd. = — ft.



1. What part of the rectangle is a ? What part of it are a and b together?
2. What part of the whole rectangle is c ?
3. $\frac{1}{3}$ of the rectangle equals how many 6ths?
4. Into how many squares the size of d can the whole rectangle be divided? What part is d ?

5. What two parts represent $\frac{5}{12}$ of the rectangle?
6. Name the parts that are $\frac{5}{12}$ of the rectangle.
7. What parts show that $\frac{2}{12} = \frac{1}{6}$? That $\frac{1}{3} = \frac{4}{12}$?
8. What parts show that $\frac{2}{3} = \frac{8}{12}$?
9. What part of the rectangle is $b + c$? Is $b + d + e$?
10. $\frac{1}{3} + \frac{1}{6} = \frac{1}{2}$; $\frac{1}{12} + \frac{1}{12} + \frac{1}{3} = \text{---}$; $\frac{2}{3} + \frac{1}{6} = \text{---}$.

Add the following:—

11. $\frac{1}{2} + \frac{1}{3}$.
12. $\frac{1}{12} + \frac{5}{6}$.
13. $\frac{1}{12} + \frac{1}{6} + \frac{1}{3}$.
14. $\frac{1}{12} + \frac{1}{6} + \frac{2}{3}$.
15. $\frac{1}{3} + \frac{5}{12}$.
16. $\frac{1}{6} + \frac{2}{3}$.
17. 6 in. + 9 in. = --- in., or 1 foot and --- inches.
18. $\frac{6}{12} + \frac{9}{12} = \frac{15}{12}$ or $1\frac{3}{4}$; $\frac{7}{12} + \frac{10}{12} = \frac{17}{12}$ or $1\frac{5}{12}$.
19. $\frac{3}{4}$ of a dollar and $\frac{1}{2}$ of a dollar are --- fourths of a dollar, or \$1 and --- .
20. How many 12ths in a rectangle? In 1 thing of any kind?
21. Tell which of the following are less than 1 foot, more than 1 foot, and equal to 1 foot: $\frac{9}{12}$ ft.; $\frac{2}{3}$ ft.; $\frac{16}{12}$ ft.; $\frac{12}{12}$ ft.; $\frac{3}{2}$ ft.; $\frac{12}{12}$ ft.; $\frac{11}{12}$ ft.; $\frac{6}{7}$ ft.; $\frac{8}{7}$ ft.; $\frac{5}{6}$ ft.

1. Find the product of $\frac{2}{3}$ of 9, and $\frac{3}{4}$ of 12.
2. A lady having \$5, spent $\frac{1}{10}$ of it for car fares. How much had she remaining?
3. A newsboy sells 20 papers daily. If he makes $\frac{1}{4}$ a cent on each, what does he earn in a week?
4. If Charles lives 8 blocks from school, what part of the distance has he gone when he has gone 4 blocks? 2 blocks? 6 blocks? 7 blocks? 5 blocks?
5. After going $3\frac{1}{2}$ blocks, how far has he yet to go?
6. Cut $2\frac{1}{2}$ inches from a stick 7 inches long, and how long a piece will remain?
7. Draw an oblong and show that $\frac{2}{3}$ and $\frac{3}{2}$ are equal.
8. Find the cost of 3 yd. of cotton at \$0.12 and $\frac{1}{2}$ yd. of ribbon at \$0.20.
9. If I buy 7 lb. of sugar at \$0.07 and $3\frac{1}{2}$ gal. of oil at \$0.10, how much change shall I receive from \$1.00?
10. In spelling 48 words Ellen misses 4. What part of the whole does she miss?
11. Take $\frac{2}{3}$ of 24 from $\frac{1}{3}$ of 90.
12. At \$1.20 a bushel, what will 3 pecks of apples cost?
13. How many ounces in a pound? 4 oz. is what part of a pound? 8 oz. is what part of a pound? 12 oz.?
14. What will 4 oz. of cloves cost at 16¢ a pound?
15. How many pounds in a ton of coal? In $\frac{1}{2}$ ton?
16. What will 1000 lb. of coal cost at \$8 a ton?
17. At \$8.00 a ton, how many pounds of coal can be bought for \$2? For \$6?

1. $\frac{1}{3}$ of my money is \$6. How much have I?
2. What is the value of $\frac{1}{2}$ of \$ $\frac{1}{2}$? $\frac{1}{3}$ of \$ $\frac{1}{2}$?
3. $\frac{2}{3}$ of \$36 = ——. 8 is $\frac{1}{3}$ of ——. $\frac{2}{10}$ of 100 = —.
4. $\frac{1}{3}$ of 45 = ——. $2\frac{1}{4}$ ft. = — inches.
5. What will it cost to launder 4 collars and 6 cuffs at $1\frac{1}{2}$ cents each?
6. How many hours in $\frac{1}{2}$ an hour + 30 minutes + $\frac{3}{4}$ of an hour + 15 minutes?
7. Draw diagrams to show the relation between $\frac{1}{4}$ and $\frac{1}{16}$.
8. What will $\frac{3}{4}$ of a pound of mace cost at 10¢ an ounce?
9. Find the cost of $1\frac{1}{2}$ gal. of oil at \$0.16, and $1\frac{1}{2}$ lb. of butter at \$0.30.
10. What will be the cost of $6\frac{1}{2}$ yd. of cotton at \$0.10, and 6 yd. of ribbon at $6\frac{1}{2}$ ¢ a yard?
11. If 4 cents is $\frac{1}{3}$ of my money, how much is the rest of it?
12. Add $\frac{2}{3}$ of a yard, 14 inches, and 2 feet.
13. What will $\frac{1}{2}$ bu. of potatoes cost, if a peck costs \$0.25?
14. A tumbler holds $\frac{1}{2}$ pint of jelly. How many tumblers will your mother need to put up $2\frac{1}{2}$ qt.?
15. What is $\frac{2}{3}$ of 20? $\frac{5}{6}$ of 24? $\frac{3}{8}$ of 32?
16. 6 is $\frac{1}{3}$ of what number? $8 = \frac{1}{3}$ of ——. $9 = \frac{1}{12}$ of —.
17. $15 = \frac{1}{2}$ of ——. $6 = \frac{1}{3}$ of —.
18. Show by drawings that: —

$$\frac{1}{2} = \frac{2}{4} = \frac{3}{6}. \quad \frac{1}{3} = \frac{2}{6} = \frac{3}{9}. \quad \frac{1}{4} = \frac{2}{8} = \frac{3}{12}.$$
19. Show by an oblong that: —

$$\frac{1}{2} + \frac{1}{4} = \frac{3}{4}. \quad \frac{1}{4} + \frac{3}{8} = \frac{5}{8}.$$
20. In the same way, show that $1 - \frac{3}{8} = \frac{5}{8}$.
21. $\frac{1}{4} + \frac{1}{8} + \frac{1}{8} = \frac{7}{8}$. Show this with an oblong.

Add by lines and by columns:—

	A	B	C	D	E	F
1.	\$ 347.00	\$ 174.56	\$ 4632.18	\$ 1234.56	\$ 46.32	\$ 734646.00
2.	1589.87	9408.23	968.76	7654.98	15.87	463956.82
3.	3462.14	7865.23	7596.13	121.15	13.29	84755.34
4.	6221.13	9860.71	457.24	9234.12	58.47	890147.65
5.	50.56	667.64	463.53	750.34	8.57	49381.10
6.	157.87	29.73	927.46	3576.29	19.68	902536.78
7.	<u>2345.78</u>	<u>174.91</u>	<u>565.84</u>	<u>927.83</u>	<u>73.64</u>	<u>82736.87</u>

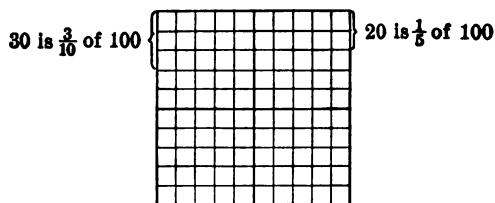
In the table below find the difference between the sums of:—

- | | | |
|--------------|--------------|--------------|
| 8. A and B. | 13. B and C. | 18. C and E. |
| 9. A and C. | 14. B and D. | 19. C and F. |
| 10. A and D. | 15. B and E. | 20. D and E. |
| 11. A and E. | 16. B and F. | 21. D and F. |
| 12. A and F. | 17. C and D. | 22. E and F. |

A	B	C	D	E	F
\$ 24.38	\$ 83.62	\$ 949.83	\$ 799.35	\$ 15.36	\$ 1286.54
6.49	45.39	697.87	869.40	746.29	364.92
17.32	169.38	749.78	309.79	126.43	3647.10
49.88	849.75	686.66	853.98	9283.14	7652.83
69.97	246.94	397.89	742.97	784.38	6372.92
83.84	938.75	469.39	688.49	654.32	993.87
<u>92.76</u>	<u>109.84</u>	<u>878.78</u>	<u>553.91</u>	<u>3789.24</u>	<u>2163.45</u>

Find the product and check by division:—

- | | | |
|-------------------------|-------------------------|-------------------------|
| 23. 2397×989 . | 26. 709×6347 . | 29. 8097×309 . |
| 24. 9368×907 . | 27. 8966×509 . | 30. 9803×407 . |
| 25. 809×6248 . | 28. 8963×807 . | 31. 6397×519 . |

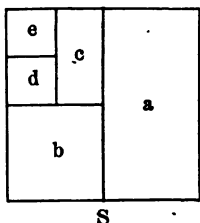


1. What part of 100 is each of the following: —
50, 25, 20, 10, 75, 80, 60, 40, 30, 70, 90?
2. Draw a square and divide it into a hundred squares.
3. Mark with a bracket, or whiten any number of rows and have your classmates tell what part you have marked.
4. Mark any number of half rows and have your classmates tell the part you have marked.
5. Mark any part your teacher may indicate.
6. How many in the following parts of a hundred?
 $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{10}$, $\frac{2}{5}$, $\frac{3}{5}$, $\frac{4}{5}$, $\frac{3}{10}$, $\frac{7}{10}$, $\frac{9}{10}$.
7. Mark on your square the fractional parts indicated above.
8. Make a square containing 64 parts and find the part that each of the following is of 64: —
16, 8, 4, 2, 32, 48, 56, 40, 44, 60.

The number that tells what *part* one number is of another, or *how many times* one number contains another is called the *ratio* of the numbers. Thus the *ratio* of 16 to 64 is $\frac{1}{4}$, and of 64 to 16 is 4.

9. What is the ratio of 15 to 45? Of 45 to 15?
10. What is the ratio of 12 to 48? Of 48 to 12?
11. What is the ratio of 32 to 16? Of 16 to 32?
12. What is the ratio of 9 to 45? Of 56 to 7?
13. What is the ratio of 25 to 100? Of 75 to 100?

1. What part is a of the whole square?
2. Call the whole square S . What is the ratio of a to S ?
3. Give the ratio of b to a ; of a to b ; of b to S .
4. Give the ratio of c to the whole square; of c to b ; of c to a .



5. What part of the whole square is d ?
6. Compare d and e . When two numbers or two magnitudes are equal their ratio is 1, that is, one is 1 times the other.
7. If the whole square represents 96, what does a represent?
8. When S is 96, find each of the other parts, as a, b, c, d , and e .
9. What is the ratio of 1 pk. to 1 bu.? Of 1 qt. to 1 gal.?
10. What is the ratio of 3 inches to 1 foot? Of 6 inches to 1 foot?
11. Give the ratio of 1 oz. to 1 lb.; of 4 oz. to 1 lb.
12. Draw a square to represent 16 and give the ratio of the following to 16:—
1, 2, 4, 8, 6, 10, 12, 14.
13. Compare $\$ \frac{1}{4}$ and $\$ \frac{1}{2}$. What is the ratio of $\$ \frac{1}{2}$ to $\$ \frac{1}{4}$? Of $\$ \frac{1}{4}$ to $\$ \frac{1}{2}$?
14. What is the ratio of 15 min. to 1 hr.? Of 30 min. to 1 hr.? Of 45 min. to 1 hr.?
15. Find the ratio of each of the following to 60:—
10, 6, 5, 15, 20, 12, 30, 40, 45, 12, 18.
16. Find the ratio of 60 to each of the numbers in Exercise 15.
17. What is the ratio of 8 to 48? If 48 lb. of tea cost \$72, what will 8 lb. cost?
18. What is the ratio of a month to a year? To 2 years?

1. Compare 6 inches and 3 inches. What is the ratio of 6 inches to 3 inches? Of 3 inches to 6 inches?

2. What is the ratio of 4 qt. to 8 qt.? Of 8 qt. to 4 qt.?

3. What is the ratio of 10 ft. to 5 ft.? Of 5 ft. to 10 ft.?

4. What is the ratio of 6 qt. to 2 qt.? Of 2 qt. to 6 qt.?

5. What is the ratio of 9 qt. to 3 qt.? Of 3 qt. to 9 qt.?

6. Find the ratio of $\frac{1}{4}$ to $\frac{1}{2}$. Of $\frac{1}{2}$ to $\frac{1}{4}$.

7. Find the ratio of $\frac{1}{8}$ to $\frac{1}{2}$. Of $\frac{1}{2}$ to $\frac{1}{8}$.

8. John has \$6 and James has \$12. What is the ratio of John's money to James's? Of James's to John's?

9. In the words *care* and *face*, what letters are found in both; that is, are *common* to both?

10. In the numbers 237 and 932, what figures are common to both?

11. What are the factors of 4 and of 6? Which one is common to both?

12. When we are asked the ratio of 4 to 6, we *measure* each number by their **common factor**, 2, and think the ratio of 2 2's to 3 2's is $\frac{2}{3}$.

13. In this way the ratio of 10 to 15 is 2 —'s to 3 —'s, or $\frac{2}{3}$; of 12 to 18 it is 2 —'s to 3 —'s, or $\frac{2}{3}$.

14. What is the ratio of 14 to 21? Of 18 to 27? Of 20 to 30?

15. If 15 dozen oranges cost \$6, what part of \$6 will 5 dozen cost? $\frac{1}{3}$ of \$6 = —.

16. If 10 bushels of potatoes cost \$7, what will 30 bushels cost?

17. What is the ratio of 16 to 40? When 40 acres of land are worth \$5000, what are 16 acres of the same land worth?

18. Compare 3 pecks and 1 bushel; 2 quarts and 1 gallon.

19. At \$1.60 per bushel, what will 3 pecks of potatoes cost?

1. What factor common to 12 and 18? What is the ratio of 12 to 18? Of 18 to 12?
2. If 18 yd. of cloth cost \$ 24, what will 12 yd. cost?
3. What is the ratio of 9 to 15? Of 15 to 9?
4. If 15 cords of wood cost \$ 50, what will 9 cords cost?
5. If 9 bushels of apples cost \$ 10, what will 15 bushels cost?
6. What is the ratio of $\frac{1}{4}$ to $\frac{1}{2}$?
7. If $\frac{1}{2}$ lb. of tea costs 40 cents, what will $\frac{1}{4}$ lb. cost?
8. What is the ratio of $2\frac{1}{2}$ to $7\frac{1}{2}$? $\text{---} \times 2\frac{1}{2} = 7\frac{1}{2}$.
9. If $2\frac{1}{2}$ yards of cloth cost \$ 7, what will $7\frac{1}{2}$ yards cost at the same price per yard?
10. What is the ratio of 20 to 50?
11. If 50 sheep cost \$ 200, what will 20 cost at the same rate?
12. What part of 36 is 24? Of 72 is 36?
13. What is the ratio of 24 to 36? Of 36 to 72?
14. A man owned 160 acres of land and sold 120. What part of his farm did he sell? ($120 = 3 \times 40$. $160 = 4 \times 40$.)
15. A farm of 160 acres is worth \$ 8000. At this rate, what is a farm of 120 acres worth?
16. What part of a ton is 500 lb.?
17. What will 500 lb. of coal cost at \$ 8 a ton?
18. What part of a yard is 9 inches?
19. At 60 cents a yard, what will 9 inches of ribbon cost?
20. What part of a pound is 12 ounces?
21. What will 12 ounces of tea cost at 80 cents a pound?
22. What will 3 quarts of vinegar cost at 20¢ per gallon?
23. What will 2 bushels of cherries cost at 8¢ per quart?

1. If a boat travels 26 miles in $2\frac{1}{2}$ hours, how far can it travel in 10 hours? (Compare $2\frac{1}{2}$ with 10.)

2. A trader exchanged 84 sheep worth $\$6\frac{1}{4}$ each for cattle worth $\$25$ each. How many cattle did he get? (Compare $\$6\frac{1}{4}$ with $\$25$.)

3. By what must $12\frac{1}{2}$ be multiplied to make 100?

4. Since $8 \times 12\frac{1}{2} = 100$, $\frac{1}{8}$ of 100 = what? At $\$12\frac{1}{2}$ each how many can be bought for $\$800$?

5. A man bought 320 acres of land at $\$37\frac{1}{2}$ per acre. He sold the whole farm for $\$15,760$. What was his gain?

6. Find the cost of 12 lb. 8 oz. of tea at 54ϕ per pound.

7. A man bought a lot for $\$3200$ and built a house on it costing $1\frac{7}{8}$ times as much. What will he gain by selling it for $\$12,000$?

8. A man bought a farm for $\$16,675$. How many acres did he buy if it cost him $\$85$ per acre?

9. A lady handed a storekeeper a $\$10$ note for the following bill. What change should she receive?

4 lb. coffee at 27ϕ .

15 lb. sugar at 6ϕ .

50 lb. flour at $4\frac{1}{2}\phi$.

10. I have $\$9856$. How much more do I need to pay for a house and lot costing $\$8400$ and a barn costing $\frac{2}{3}$ as much?

11. Find the cost of:—

8 hens at $\$6$ per dozen.

12 ounces at $\$1.20$ per pound.

3 pecks at $\$6.80$ per bushel.

12. In 1864 a gentleman was 32 years old. How old was he in 1903?

An integer or whole number is made up of one or more *whole* things.

A fraction is made up of one or more of the *equal parts* of a thing.

1. Which of these are fractions and which integers?

3 feet; $\frac{3}{4}$ inch; \$42; $\frac{5}{8}$ rd.; $2\frac{2}{8}$ yd.; $\$ \frac{4}{5}$; $\frac{8}{9}$ qt.

2. What does $\frac{1}{4}$ of a dollar equal? $1\frac{1}{2}$ of a foot?

3. Is $\$ \frac{5}{4}$ more or less than \$1? How much?

4. Is $1\frac{1}{2}$ ft. more than 1 foot? How much?

5. Tell which of these represent more than 1:—

$\frac{2}{3}$ yd.; $\frac{9}{8}$ gal.; $1\frac{3}{5}$; $\frac{6}{7}$; $\frac{5}{4}$; $\frac{7}{8}$.

A fraction *less* in value than 1 is a **proper fraction**.

A fraction that equals 1 or is *greater* in value than 1 is an **improper fraction**.

6. What is the value of $\$ \frac{5}{4}$? Of $1\frac{1}{2}$ ft.? Of $1\frac{0}{4}$ gal.?

An integer and a fraction together make a **mixed number**.

7. Change the following to mixed numbers:—

$\$ \frac{3}{2}$; $\$ \frac{5}{4}$; $\frac{7}{2}$ qt.; $\frac{8}{3}$ yd.; $\frac{7}{4}$ bu.; $1\frac{8}{9}$ lb.; $1\frac{1}{2}$ qt.

8. How many 4ths in $2\frac{1}{4}$? In $1\frac{3}{4}$? In $3\frac{1}{4}$?

9. Change $1\frac{3}{5}$ to a mixed number.

WORK

5 fifths $\overline{) 138 \text{ fifths}}$

$27\frac{3}{5}$

Therefore $1\frac{3}{5} = 27\frac{3}{5}$.

EXPLANATION. 5 fifths = 1; in 138 fifths there are as many 1's as there are 5's in 138, or $27\frac{3}{5}$.

Written

Change to mixed numbers:—

10. $\frac{63}{8}$.

12. $\frac{43}{6}$.

14. $\frac{247}{18}$.

16. $\frac{631}{10}$.

11. $\frac{43}{9}$.

13. $1\frac{07}{12}$.

15. $1\frac{23}{14}$.

17. $2\frac{81}{8}$.

18. Which is more, $2\frac{34}{18}$ ft. or $14\frac{9}{16}$ ft.?

1. What is $\frac{1}{4}$ of 9 inches?

EXPLANATION. $\frac{1}{4}$ of 9 inches is 2 inches, with 1 inch remaining. $\frac{1}{4}$ of 1 inch, or 1 inch divided into 4 equal parts, equals $\frac{1}{4}$ inch. Hence, $\frac{1}{4}$ of 9 inches = $2\frac{1}{4}$ inches.

2. What is $\frac{1}{6}$ of 11 inches? 6. Find $\frac{1}{10}$ of \$91.
3. What is $\frac{1}{8}$ of 13 pounds? 7. Find $\frac{1}{8}$ of 97 gallons.
4. What is $\frac{1}{5}$ of 73 yards? 8. Find $\frac{1}{12}$ of 85 yr.
5. What is $\frac{1}{3}$ of 21 hours? 9. $\frac{1}{24}$ of 25 days = —.
10. Draw a line 1 inch long and another 2 inches long.
11. Divide each line into 4 equal parts. Compare $\frac{1}{4}$ of 2 inches with $\frac{3}{4}$ of 1 inch.
12. In the same way draw an inch line and a three-inch line, and compare $\frac{1}{4}$ of 3 inches with $\frac{3}{4}$ of 1 inch.

13. What is $\frac{1}{4}$ of 11 inches?

EXPLANATION. $\frac{1}{4}$ of 11 inches = 2 inches and 3 inches remaining. $\frac{1}{4}$ of 3 inches was seen in Exercise 12 to = $\frac{3}{4}$ of an inch. Hence, $\frac{1}{4}$ of 11 inches = $2\frac{3}{4}$ inches.

14. What is $\frac{1}{5}$ of 19 inches? 16. What is $\frac{1}{5}$ of 29 yards?
15. What is $\frac{1}{10}$ of 27 pounds? 17. What is $\frac{1}{12}$ of 77 yards?

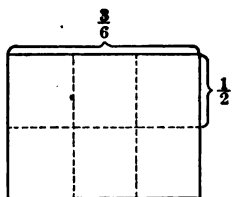
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18. If a railway train runs 537 miles in 25 hours, how far does it run in 1 hour?
19. If 32 horses eat 653 bushels of oats, what does one horse eat?
20. If 47 cars carry 1000 tons, what does each car carry?
21. In 86 pieces of cotton there are 2573 yards. If the pieces are of equal length, how many yards in each piece?
22. I bought a farm of 320 acres for \$2000. What was that per acre?
23. I raised 1552 bushels of wheat on 48 acres. What was the average yield per acre?

1. The oblong shows that $\frac{1}{2} = \frac{3}{6}$. Draw another to show that $\frac{1}{3} = \frac{2}{6}$.

2. In the same way show that $\frac{1}{3} = \frac{4}{12}$;
 $\frac{1}{3} = \frac{3}{9}$.

3. By an oblong show that $1 - \frac{5}{12} = \frac{7}{12}$;
 $1 - \frac{2}{9} = \frac{7}{9}$.



4. What is the ratio of $\frac{1}{3}$ to $\frac{1}{2}$?

SUGGESTION. Change both to 6ths. See the oblong at the top of page.

5. What is the ratio of $\frac{1}{2}$ to $\frac{2}{3}$?

6. What is the ratio of 4 to 8? Of 6 to 9?

7. If 4 cents will buy 10 cakes, how many will 16 cents buy?

8. If 16 cents will buy 3 lb. of crackers, what part of a pound will 4 cents buy?

9. What is the ratio of 1500 pounds to 1 ton? How many 500's in 1500? In 2000? Then 1500 pounds = $\frac{3}{4}$ of 2000, or the ratio of 1500 to 2000 = $\frac{3}{4}$.

10. If hay is \$16 a ton, what part of \$16 will 1500 pounds cost?
 $\frac{3}{4}$ of \$16 = —.

11. If 8 ounces of butter cost 13 cents, what will 24 ounces cost?

12. If 48 ounces of water will fill a certain jar, what part of it will 24 ounces fill?

13. I pay 96 cents for 12 quarts of berries. What should I pay for 8 quarts? What is the ratio of 8 to 12?

14. 8 is $\frac{2}{3}$ of what number? 15. \$10 is $\frac{5}{8}$ of what?

16. I spend $\frac{9}{10}$ of money and have \$7 left. How much had I?

17. I cut off $\frac{2}{3}$ of a piece of ribbon. One foot remained. How much did I cut off?

18. How far did I go when I rode $\frac{1}{2}$ the way and walked a mile to reach home?

1. Name the terms of a fraction.
2. Which term shows the *size* of the equal parts, or the fractional unit?
3. Which term shows the *number* of units?
4. Which term names the fractional unit?
5. Which would you choose, $\$ \frac{1}{2}$ or $\$ \frac{1}{10}$? Why?
6. May fractions that are alike in *value* differ in *form*?
7. Name four fractions equal in value to $\frac{1}{2}$.
8. Change $\frac{1}{3}$ to 9ths. Which is the smaller unit, $\frac{1}{9}$ or $\frac{1}{3}$?
9. Compare $\frac{1}{3}$ and $\frac{1}{9}$. How many 9ths will it take to equal $\frac{1}{3}$?
10. Change $\frac{2}{3}$ to 12ths. How do $\frac{1}{3}$ and $\frac{1}{12}$ compare in size? It will take how many 12ths to equal $\frac{1}{3}$? How many, then, to equal $\frac{2}{3}$?
11. In changing gallons to quarts, are you changing to larger or smaller units? Do you increase or decrease the number of units?
12. In changing 3ds to 12ths, are you changing to larger or smaller units? Do you increase or decrease the number of units?
13. Draw an oblong and divide it into 6ths. Show your teacher the unit you use in naming $\frac{5}{6}$ of the oblong.
14. What change will you make in these units to represent 12ths?
15. The five equal parts have become how many of the twelve equal parts?
16. Does a large denominator mean large or small units?
17. Which would you prefer, $\frac{1}{8}$ or $\frac{1}{5}$ of an apple?
18. Is $\frac{1}{100}$ a very large or a very small fractional unit? How many of them make 1?

1. By a drawing, change halves to sixths.
2. How did you change each of the 2 equal parts?
3. How is the *number* of equal parts changed?
4. How is the *size* of the equal parts, or units, changed?
5. Change $\frac{2}{3}$ to 9ths. How will the *size* be changed? The *number*?

6. Change $\frac{3}{4}$ to 16ths. How do $\frac{1}{4}$ and $\frac{1}{16}$ compare in size?

7. Change $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{6}$ to 12ths; to 36ths.

8. Change the following fractions to smaller units:—

$$\frac{1}{8} = \frac{?}{48}; \quad \frac{1}{12} = \frac{?}{48}; \quad \frac{1}{12} = \frac{?}{60}; \quad \frac{1}{15} = \frac{?}{60}; \quad \frac{1}{8} = \frac{?}{48}; \quad \frac{1}{8} = \frac{?}{36}.$$

9. To what units larger than 60ths may the following be changed:—
 $\frac{1}{3}$, $\frac{1}{5}$, $\frac{1}{6}$, $\frac{1}{10}$, $\frac{1}{15}$?

10. Change to 60ths:—

$$\frac{1}{5}, \quad \frac{1}{6}, \quad \frac{1}{4}, \quad \frac{1}{12}, \quad \frac{1}{3}, \quad \frac{1}{15}, \quad \frac{1}{20}.$$

11. Give 8 units to which 5ths may be changed.

$$12. \quad \frac{1}{5} = \frac{?}{10}, \quad \frac{1}{15}, \quad \frac{1}{20}, \quad \frac{1}{25}, \quad \frac{1}{30}, \quad \frac{1}{35}, \quad \frac{1}{40}, \quad \frac{1}{45}.$$

$$13. \quad \frac{2}{3} = \frac{?}{9}, \quad \frac{1}{12}, \quad \frac{1}{15}, \quad \frac{1}{18}, \quad \frac{1}{21}, \quad \frac{1}{24}, \quad \frac{1}{27}, \quad \frac{1}{30}.$$

$$14. \quad \frac{3}{4} = \frac{?}{8}, \quad \frac{1}{12}, \quad \frac{1}{15}, \quad \frac{1}{20}, \quad \frac{1}{24}, \quad \frac{1}{28}, \quad \frac{1}{32}, \quad \frac{1}{36}, \quad \frac{1}{40}.$$

15. Change the following to 24ths:—

$$\frac{2}{3}, \quad \frac{3}{4}, \quad \frac{5}{6}, \quad \frac{7}{8}, \quad 1\frac{1}{2}.$$

16. Change the following to 36ths:—

$$\frac{2}{3}, \quad \frac{3}{4}, \quad \frac{5}{6}, \quad \frac{7}{8}, \quad \frac{1}{12}, \quad \frac{1}{15}.$$

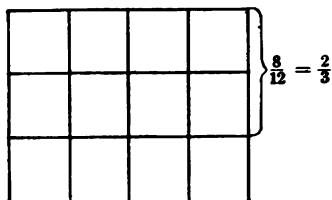
17. Change $\frac{5}{8}$ to five different fractions with smaller units.

$$18. \quad 1\frac{1}{2} = \frac{?}{24}, \quad \frac{?}{36}, \quad \frac{?}{48}, \quad \frac{?}{60}, \quad \frac{?}{72}, \quad \frac{?}{84}, \quad \frac{?}{96}, \quad \frac{?}{108}.$$

19. Change $\frac{4}{5}$ to 8 different fractions with smaller units.

$$20. \quad \frac{3}{4} = \frac{?}{16}; \quad \frac{5}{8} = \frac{?}{16}; \quad \frac{7}{8} = \frac{?}{16}; \quad \frac{5}{8} = \frac{?}{24}; \quad \frac{7}{8} = \frac{?}{24}.$$

$$21. \quad \frac{2}{3} = \frac{?}{45}; \quad \frac{3}{4} = \frac{?}{42}; \quad \frac{2}{3} = \frac{?}{31}; \quad \frac{5}{8} = \frac{?}{96}; \quad \frac{7}{8} = \frac{?}{84}; \quad \frac{8}{15} = \frac{?}{60}.$$



1. Into how many parts is this oblong divided?

2. The drawing shows $\frac{8}{12} = \frac{2}{3}$. In this way show that $\frac{8}{12} = \frac{1}{3}$.

3. In the same way show that $\frac{6}{12} = \frac{1}{2}$; $\frac{9}{12} = \frac{3}{4}$; $\frac{4}{12} = \frac{1}{3}$; $\frac{3}{12} = \frac{1}{4}$; $\frac{1}{12}$.

4. Which of these are the *larger units*, and which the *smaller*?

5. Draw an oblong and divide it into 15ths. Find in it the value of the following in larger units: $\frac{5}{15}$, $\frac{3}{15}$, $\frac{10}{15}$, $\frac{6}{15}$, $\frac{9}{15}$, $\frac{12}{15}$.

6. Change $\frac{2}{3}$ to the largest possible fractional unit.

SUGGESTION. Compare $\frac{2}{3}$ and $\frac{1}{3}$. $\frac{2}{3} = \frac{2}{3}$.

7. Change $\frac{3}{4}$ to the largest unit.

SUGGESTION. There are 3 2's in 6. Every 2 eighths make $\frac{1}{4}$; hence $\frac{3}{4} = \frac{3}{4}$.

Change the following fractions to fractions with the largest possible unit: —

8. $\frac{2}{12}$, $\frac{10}{12}$, $\frac{3}{12}$, $\frac{9}{12}$, $\frac{4}{12}$, $\frac{8}{12}$.

12. $\frac{6}{30}$, $\frac{12}{30}$, $\frac{18}{30}$, $\frac{24}{30}$.

9. $\frac{3}{18}$, $\frac{15}{18}$, $\frac{6}{18}$, $\frac{12}{18}$, $\frac{9}{18}$, $\frac{16}{18}$.

13. $\frac{6}{36}$, $\frac{30}{36}$, $\frac{4}{36}$, $\frac{8}{36}$.

10. $\frac{6}{24}$, $\frac{18}{24}$, $\frac{4}{24}$, $\frac{20}{24}$, $\frac{8}{24}$, $\frac{14}{24}$.

14. $\frac{28}{36}$, $\frac{32}{36}$, $\frac{4}{36}$, $\frac{20}{36}$.

11. $\frac{4}{20}$, $\frac{8}{20}$, $\frac{12}{20}$, $\frac{16}{20}$, $\frac{6}{20}$, $\frac{25}{20}$.

15. $\frac{6}{30}$, $\frac{18}{30}$, $\frac{12}{30}$, $\frac{54}{30}$.

16. Give the different numbers of 12ths that can be changed to larger units.

17. Can 3rds, 5ths, 7ths, 11ths, or 13ths be changed to larger units?

18. What is the largest unit to which $\frac{75}{100}$ can be changed?

GREATEST COMMON DIVISOR

1. What letters are found in both *sing* and *rang*, that is, what letters are *common* to both words?

2. What figures are common to the numbers 1476 and 2571?

3. Name all the divisors of both 24 and of 36.

4. Which ones are *common* to both?

5. What divisors are *common* to both 48 and 60?

6. What is the *greatest* number that will divide both 36 and 48?

7. What is the *greatest* number that will divide both 48 and 60?

The *greatest* number that will divide each of two or more numbers is called their **greatest common divisor** (*g. c. d.* or *G. C. D.*).

8. What is the greatest common divisor of 18 and 27?

Give the greatest common divisor of the following:—

9. 36 and 48. 13. 40 and 72. 17. 75 and 100.

10. 21 and 35. 14. 54 and 81. 18. 36 and 108.

11. 56 and 64. 15. 64 and 72. 19. 96 and 144.

12. 49 and 63. 16. 27 and 96. 20. 63 and 91.

21. When you change 12ths to 4ths, how do you affect each of the equal parts?

22. You will have how many of these in the fraction as compared with the number of 12ths?

EXPLANATION. Since it takes $\frac{3}{12}$ to make $\frac{1}{4}$, there will be $\frac{1}{3}$ as many 4ths as 12ths.

Observe then that you cannot change 12ths to 4ths unless 3 is a factor of the *number* of 12ths.

23. When can you change 15ths to 3ds? 18ths to 6ths?

Observe that a fraction cannot be changed to larger units unless both terms of the fraction have a common divisor.

1. Change $\frac{9}{8}$ to an equivalent fraction in larger units.

SUGGESTION. Since 12 is the largest divisor common to both terms, this fraction is equal to $\frac{9}{8}$; for making the units 12 times as large, or 8ths, there will be but $\frac{1}{12}$ as many of them, or 6.

Notice that this result is the same as we should have got by dividing both terms by their greatest common divisor.

2. Change $\frac{132}{144}$ to an equivalent fraction in larger units.

WORK

$$\frac{132}{144} = \frac{12 \cancel{)132}}{12 \cancel{)144}} = \frac{11}{12}$$

The result is the same if we divide by any common divisor; thus, $\frac{6 \cancel{)132}}{6 \cancel{)144}} = \frac{2 \cancel{)22}}{2 \cancel{)24}} = \frac{11}{12}$.

In the same way change the following to equivalent fractions in the largest possible unit:—

- | | | | |
|------------------------|------------------------|-------------------------|-------------------------|
| 3. $\frac{96}{144}$. | 6. $\frac{128}{240}$. | 9. $\frac{160}{384}$. | 12. $\frac{150}{160}$. |
| 4. $\frac{144}{168}$. | 7. $\frac{81}{888}$. | 10. $\frac{168}{240}$. | 13. $\frac{150}{450}$. |
| 5. $\frac{120}{225}$. | 8. $\frac{72}{288}$. | 11. $\frac{64}{224}$. | 14. $\frac{182}{168}$. |

CHANGES IN THE FORM OF A FRACTION: REVIEW

Oral

- Change to mixed numbers: $\frac{25}{7}$, $\frac{28}{9}$, $\frac{37}{5}$, $\frac{48}{8}$, $\frac{65}{9}$, $\frac{76}{11}$.
- Change to improper fractions: $1\frac{1}{2}$, $2\frac{1}{3}$, $3\frac{1}{4}$, $7\frac{2}{5}$, $12\frac{1}{2}$.
- Change to 72ds: $\frac{7}{8}$, $\frac{5}{9}$, $\frac{5}{12}$, $\frac{8}{9}$, $\frac{7}{12}$, $\frac{1}{2}$, $\frac{1}{3}$.

Change to largest units:—

- $\frac{3}{12}$, $\frac{9}{12}$, $\frac{10}{12}$, $\frac{12}{16}$, $\frac{14}{16}$, $\frac{6}{16}$, $\frac{15}{16}$, $\frac{30}{80}$, $\frac{50}{80}$.
 - $\frac{14}{32}$, $\frac{20}{32}$, $\frac{30}{32}$, $\frac{18}{32}$, $\frac{36}{32}$, $\frac{33}{32}$, $\frac{20}{45}$, $\frac{24}{45}$, $\frac{24}{44}$.
 - Compare $\frac{7}{21}$ and $\frac{9}{27}$; $\frac{15}{20}$ and $\frac{27}{36}$; $\frac{24}{34}$ and $\frac{38}{47}$.
 - Change to mixed numbers: $\frac{37}{7}$, $\frac{31}{16}$, $\frac{90}{12}$, $\frac{100}{9}$, $\frac{74}{8}$.
 - 10 is what part of 12? Do they have a common divisor?
- SUGGESTION.** 10 is 5 twos and 12 is 6 twos; hence, 10 to 12 is $\frac{5}{6}$.
- 16 is what part of 18? 10. 24 is what part of 36?

1. Add 3 feet, 2 yards, 24 inches.

2. To what *common unit* did you change them?

3. Add 3 qt. 1 gal. 3 pt. To what *unit* did you change them?

4. Can you add 6 roses, 5 lilies, and 7 pinks? Can you think of some *common name* or *common unit* that will apply to all?

5. From 75 minutes subtract 1 hour. What change in form did you make; that is, to what common unit did you change them?

6. Add $\frac{1}{2}$ and $\frac{1}{4}$. To what common unit did you change them?

PRINCIPLE. *Before integers or fractions can be added or subtracted, they must have units of the same name and of the same size or value.*

7. Add $\frac{1}{2}$ and $\frac{1}{8}$. Can $\frac{1}{2}$ be changed to 8ths?

8. Add $\frac{1}{8}$ and $\frac{1}{4}$. Can $\frac{1}{8}$ be changed to 4ths? To what like unit can they be changed? $\frac{1}{8} + \frac{1}{4} = \frac{1}{8} + \frac{2}{8} = \frac{3}{8}$.

Written

Change these fractions to like units, and find their sum and their difference:—

9. $\frac{1}{5}, \frac{1}{10}$.

12. $\frac{5}{8}, \frac{3}{10}$.

15. $\frac{1}{12}, \frac{4}{9}$.

18. $\frac{2}{3}, \frac{1}{6}$.

10. $\frac{1}{2}, \frac{1}{3}$.

13. $\frac{2}{3}, \frac{1}{4}$.

16. $\frac{2}{3}, \frac{4}{9}$.

19. $\frac{3}{8}, \frac{7}{8}$.

11. $\frac{2}{3}, \frac{1}{6}$.

14. $\frac{5}{8}, \frac{1}{4}$.

17. $\frac{3}{8}, \frac{5}{12}$.

20. $\frac{3}{10}, \frac{2}{5}$.

21. Add $1\frac{1}{2}, 2\frac{1}{4}, 3$. $1\frac{1}{2} + 2\frac{1}{4} + 3 = 1\frac{2}{4} + 2\frac{1}{4} + 3 = 6\frac{3}{4}$.

Add the following mixed numbers:—

22.

23.

24.

25.

26.

$3\frac{1}{2}$

$3\frac{1}{4}$

$1\frac{1}{2}$

$1\frac{1}{4}$

$2\frac{1}{2}$

$2\frac{1}{4}$

$1\frac{3}{8}$

$7\frac{3}{4}$

$7\frac{3}{8}$

$3\frac{1}{4}$

$4\frac{1}{2}$

$4\frac{1}{4}$

$6\frac{1}{2}$

$6\frac{1}{4}$

$6\frac{1}{2}$

1. If we divide 6ths into 2 equal parts, we have —.
2. If we divide 6ths into 3 equal parts, we have —.
3. 6ths divided into 4 equal parts give —; into 5 equal parts give —.

It is evident that the smaller units to which any fractional unit may be changed are units whose denominators are multiples of the given denominator.

4. Change $\frac{1}{16}$ and $\frac{1}{20}$ to like units.
 - a. What prime factor is found in 20 that is not in 16?
 - b. Must this factor 5 be in all multiples of 20?
 - c. A common multiple of both must have besides 16 what other factor?
 - d. Then 5×16 , or 80, is the least multiple common to both.
 - e. Then we are to change $\frac{1}{16}$ and $\frac{1}{20}$ to 80ths.
5. Change $\frac{1}{15}$ and $\frac{1}{20}$ to like units.

HINT. What prime factor in 15 is not in 20?
6. To what like units can 15ths and 25ths be changed?

HINT. What prime factor in 15 is not in 25?
7. Change $\frac{1}{3}$ and $\frac{1}{5}$ to like units, and add.
8. Change $\frac{1}{4}$ and $\frac{1}{8}$ to like units, and add.
9. Change $\frac{1}{2}$ and $\frac{1}{10}$ to like units, and add.
10. What is the least common multiple (dividend) of 12 and 18? Of 15 and 35? Of 16 and 24?
11. Change $\frac{5}{12}$ and $\frac{1}{18}$ to like units, and subtract.
12. Change $\frac{2}{15}$ and $\frac{1}{30}$ to like units, and add.
13. Change $\frac{3}{16}$ and $\frac{1}{4}$ to like units, and subtract.
14. Name 3 like units to which $\frac{1}{2}$ and $\frac{1}{3}$ can be changed. Which of these units would you select, if you were to add these fractions? Why?

We have learned that to add or subtract unlike fractions we must

- 1st. *Change them to fractions with like units; then*
- 2d. *Find the sum or difference of the numbers of these units; and*
- 3d. *Change the result to its simplest form.*

1. Find the sum of $\frac{1}{3}\frac{2}{3}$ and $\frac{3}{7}\frac{2}{7}$, and also their difference.

METHOD

$$\begin{array}{r} \frac{1}{3}\frac{2}{3} = \frac{2}{3}\frac{2}{3} \\ \frac{3}{7}\frac{2}{7} = \frac{6}{7}\frac{2}{7} \\ \hline \text{Sum} = \frac{10}{7}\frac{7}{2} = 1\frac{3}{7}\frac{7}{2} \end{array}$$

EXPLANATION. The common unit is 72ds. To get 72ds from 36ths, we divide each 36th into 2 parts, hence $\frac{1}{3}\frac{2}{3} = \frac{2}{7}\frac{2}{7}$.

$$\text{Difference} = \frac{3}{7}\frac{1}{2}$$

Find the sum and difference:—

$$2. \frac{1}{3}\frac{7}{8}, \frac{7}{10}\frac{1}{8}.$$

$$5. \frac{7}{18}, \frac{4}{18}.$$

$$8. \frac{7}{12}, \frac{3}{14}\frac{1}{4}.$$

$$3. \frac{1}{3}\frac{3}{8}, \frac{1}{11}\frac{2}{4}.$$

$$6. \frac{1}{2}\frac{5}{8}, \frac{1}{14}.$$

$$9. \frac{1}{4}\frac{1}{4}, \frac{1}{18}.$$

$$4. \frac{1}{2}\frac{3}{8}, \frac{7}{15}.$$

$$7. \frac{4}{18}, \frac{1}{14}\frac{3}{4}.$$

$$10. \frac{2}{10}, \frac{1}{10}\frac{1}{10}.$$

11. Find the sum of $24\frac{5}{8}$ and $17\frac{5}{8}$, and also their difference.

METHOD

$$24\frac{5}{8} = 24\frac{1}{8}\frac{4}{8} = 23\frac{2}{8}\frac{4}{8}$$

$$17\frac{5}{8} = 17\frac{1}{8}\frac{4}{8} = 17\frac{1}{8}\frac{4}{8}$$

$$\text{Sum} = 42\frac{7}{8}$$

$$\text{Difference} = 6\frac{1}{8}\frac{4}{8}$$

SUGGESTION. $\frac{1}{8}$ cannot be taken from $\frac{1}{8}$; $24\frac{1}{8}\frac{4}{8} = 23\frac{2}{8}\frac{4}{8}$; $\frac{1}{8}$ from $\frac{2}{8} = \frac{1}{8}$. $23 - 17 = 6$. Difference, $6\frac{1}{8}\frac{4}{8}$.

$$12. \text{Add: } 83\frac{7}{8}, 39\frac{5}{8}, 41\frac{5}{8}.$$

$$15. \text{Add: } 4\frac{1}{2}, 6\frac{1}{2}, 4\frac{3}{8}, 7\frac{1}{2}.$$

$$13. \text{Add: } 114\frac{4}{8}, 72\frac{3}{8}, 96\frac{3}{8}.$$

$$16. \text{Add: } 19\frac{3}{8}, 16\frac{3}{4}, \frac{7}{10}, \frac{1}{10}.$$

$$14. \text{Add: } \frac{7}{8}, \frac{5}{8}, \frac{1}{2}, \frac{3}{4}.$$

$$17. \text{Add: } 16, 24\frac{3}{8}, \frac{3}{4}, 1\frac{7}{8}.$$

Find the sum and difference:—

$$18. 63\frac{7}{12}, 13\frac{5}{6}.$$

$$20. 18\frac{3}{8}, 13\frac{1}{8}.$$

$$22. 56\frac{3}{8}, 43\frac{1}{4}.$$

$$19. 24\frac{1}{4}, 19\frac{5}{8}.$$

$$21. 47\frac{1}{8}, 39\frac{1}{2}.$$

$$23. 61\frac{1}{4}, 19\frac{7}{8}.$$

Use any two adjacent fractions in either columns or lines, and find their sum. Find differences of adjacent fractions.

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>
1.	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{16}$	$\frac{1}{32}$	$\frac{1}{64}$	$\frac{1}{128}$	$\frac{1}{256}$	$\frac{1}{512}$
2.	$\frac{2}{3}$	$\frac{1}{6}$	$\frac{1}{12}$	$\frac{1}{24}$	$\frac{1}{48}$	$\frac{1}{96}$	$\frac{1}{192}$	$\frac{1}{384}$	$\frac{1}{768}$
3.	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{5}{16}$	$\frac{3}{8}$	$\frac{7}{16}$	$\frac{9}{32}$	$\frac{5}{16}$	$\frac{3}{8}$	$\frac{7}{16}$
4.	$\frac{1}{8}$	$\frac{1}{16}$	$\frac{3}{32}$	$\frac{1}{16}$	$\frac{5}{32}$	$\frac{3}{16}$	$\frac{1}{8}$	$\frac{1}{16}$	$\frac{3}{32}$
5.	$\frac{1}{8}$	$\frac{5}{16}$	$\frac{9}{32}$	$\frac{1}{8}$	$\frac{5}{16}$	$\frac{9}{32}$	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{16}$

Oral and Written

Using the numbers in the columns, find sums and differences as directed below. Each direction gives five examples.

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>
1.	$\frac{2}{3}$	$\frac{1}{12}$	$\frac{9}{16}$	$\frac{7}{8}$	$3\frac{1}{2}$	$13\frac{1}{8}$	$63\frac{7}{12}$	$81\frac{5}{24}$
2.	$\frac{3}{4}$	$\frac{7}{16}$	$\frac{1}{11}$	$\frac{2}{11}$	$4\frac{3}{8}$	$24\frac{1}{4}$	$59\frac{1}{8}$	$94\frac{3}{8}$
3.	$\frac{5}{8}$	$\frac{1}{16}$	$\frac{7}{9}$	$\frac{2}{9}$	$6\frac{1}{16}$	$37\frac{1}{2}$	$71\frac{3}{8}$	$85\frac{1}{8}$
4.	$\frac{7}{8}$	$\frac{1}{9}$	$\frac{5}{12}$	$\frac{6}{144}$	$4\frac{5}{4}$	$41\frac{3}{8}$	$34\frac{5}{8}$	$64\frac{1}{18}$
5.	$\frac{3}{5}$	$\frac{9}{10}$	$\frac{1}{8}$	$\frac{1}{25}$	$7\frac{1}{5}$	$30\frac{2}{15}$	$29\frac{3}{10}$	$42\frac{1}{4}$

1-5. $a + \frac{1}{2}$.	51-55. $b + c$.	101-105. $f + h$.
6-10. $b + \frac{2}{3}$.	56-60. $a + c$.	106-110. $g + h$.
11-15. $c + \frac{3}{4}$.	61-65. $c + d$.	111-115. $h - g$.
16-20. $d + \frac{7}{8}$.	66-70. $a + d$.	116-120. $h - e$.
21-25. $10 - e$.	71-75. $b + a$.	121-125. $a + b + c$.
26-30. $e - 2\frac{1}{3}$.	76-80. $e - d$.	126-130. $b + c + d$.
31-35. $50 - f$.	81-85. $e + f$.	131-135. $a + c + d$.
36-40. $100 - g$.	86-90. $f - e$.	136-140. $e + f + g$.
41-45. $h - 11\frac{3}{4}$.	91-95. $f + g$.	141-145. $f + g + h$.
46-50. $a + b$.	96-100. $g - e$.	146-150. $e + g + h$.

1. A man sold $\frac{3}{8}$ of his crop at one time and $\frac{4}{15}$ at another. What part had he left? Compare what he had left with what he sold the first time; the second time.

2. Mr. Brown owned $\frac{5}{7}$ of a farm. Mr. Lee owned the remainder. How much has Mr. Brown if Mr. Lee has 80 acres?

HINT. Mr. Brown has $2\frac{1}{2}$ times as much as Mr. Lee. Why?

3. A man travels $\frac{5}{12}$ of his journey on Monday, $\frac{1}{3}$ of it on Tuesday. What part of it has he to travel on Wednesday?

4. Compare the distance traveled on Monday and Tuesday; Monday and Wednesday; Tuesday and Wednesday.

5. If 3 times my money is \$1545, how much have I?

6. If $\frac{1}{8}$ of a certain distance is 115 miles, what is the rest of it?

7. John has 4 times as much money as James. How much has John if James has \$32.80?

8. How much has James if John has \$316.40?

9. A farmer has a flock of 680 sheep. He sells $\frac{2}{5}$ of them at \$4 each, $\frac{1}{4}$ of them at \$7, and the remainder at \$5.50. What does he get for all?

10. $\frac{1}{3}$ of my wheat crop is harvested the first week and $\frac{2}{15}$ the second. What part remains to be done the third week?

11. If 33 acres remain for the third week, how many acres had I in all?

12. $2\frac{1}{2}$ lb. are what part of $12\frac{1}{2}$ lb.? If I can get $2\frac{1}{2}$ lb. of tea for 90¢, what will $12\frac{1}{2}$ lb. cost me?

13. $\frac{7}{8}$ of a crop is sold and 136 bushels remain. How much was sold?

1. Frank had \$3.08. He spent $\frac{1}{4}$ of it for a cap, $\frac{1}{4}$ of it for a ball, and the remainder for a book. What did the book cost?

2. After spending $\frac{1}{3}$ and $\frac{1}{4}$ of my money, what part of it have I left? If I had \$248 at first, how much have I left?

3. I spent $\frac{1}{3}$ of my money for a ball, $\frac{1}{4}$ of it for a bat, $\frac{1}{5}$ of it for catching-gloves, and had 21¢ left. What did I pay for each?

4. A man traveled $\frac{3}{4}$ of his journey the first week, $\frac{2}{5}$ of it the second, and had 66 miles yet to go. How far had he traveled?

SUGGESTION. $\frac{3}{4} + \frac{2}{5} = \frac{23}{20}$, hence he had traveled $\frac{23}{20}$ and had $\frac{7}{20}$ of the journey yet to go. Compare $\frac{23}{20}$ and $\frac{7}{20}$ and

EXPLAIN: $\frac{23}{20} \times 66 \text{ mi.} = 29 \times 11 \text{ mi.} = 319 \text{ mi.}$

5. After spending $\frac{2}{3}$ of his money for a lot and $\frac{1}{4}$ of it for a house, a man had \$850 left. What did he pay for each?

EXPLAIN: $\frac{2}{3} + \frac{1}{4} = \frac{11}{12}$; $1 - \frac{11}{12} = \frac{1}{12}$.

$4 \times \$850 = \text{cost of the lot}; 5 \times \$850 = \text{cost of the house.}$

6. $\frac{1}{3}$ of my farm is in pasture, $\frac{2}{5}$ in corn, and the remainder in wheat. How many acres of pasture and of corn have I if I have 54 acres of wheat?

7. Compare $\frac{5}{8}$ yd. with $\frac{3}{4}$ yd. To what common unit did you change them before making the comparison?

8. $\frac{2}{3}$ of a flock of sheep are black. How many sheep are there if there are 80 black ones?

9. In a southern state $\frac{3}{5}$ of the population of a certain county are colored. How many whites in the county if the colored population is 18,693?

10. I sold my farm for \$3600, which was $\frac{1}{3}$ more than it cost me. Find the cost.

HINT. $\$3600 = \frac{4}{3}$ of the cost + $\frac{1}{3}$ of the cost.

The multiplier, an integer; the multiplicand, a fraction.

1. $4 \times \$\frac{1}{2} =$ — dollars; $12 \times \$\frac{1}{2} =$ — dollars; $20 \times \$\frac{1}{2} =$ — dollars.

2. 5×7 in. = — inches, or — foot and — inches.

3. $5 \times \frac{7}{12}$ ft. = $\frac{1}{12}$ ft. or $2\frac{1}{12}$ ft.

Find the product of the following: —

4. $5 \times \frac{2}{3}$.

8. $5 \times \frac{4}{7}$.

12. $4 \times \frac{3}{7}$.

16. $9 \times \frac{7}{10}$.

5. $6 \times \frac{2}{3}$.

9. $8 \times \frac{3}{8}$.

13. $7 \times \frac{7}{8}$.

17. $6 \times \frac{4}{5}$.

6. $4 \times \frac{2}{3}$.

10. $2 \times \frac{4}{5}$.

14. $3 \times \frac{3}{11}$.

18. $8 \times \frac{7}{8}$.

7. $4 \times \frac{5}{8}$.

11. $6 \times \frac{5}{11}$.

15. $5 \times \frac{5}{8}$.

19. $10 \times \frac{4}{7}$.

20. What will 5 lb. of crackers cost at $6\frac{1}{2}$ cents a pound?

PROCESS. $5 \times 6\text{¢} = 30\text{¢}$

$5 \times \frac{1}{2}\text{¢} = \frac{2\frac{1}{2}}{2}\text{¢}$

$5 \times 6\frac{1}{2}\text{¢} = 32\frac{1}{2}\text{¢}$

21. What will 12 lb. of meat cost at $8\frac{3}{4}$ cents a pound?

22. Find the cost of 10 yd. of ribbon at $8\frac{3}{8}$ cents a yard.

Find the cost of the following: —

23. 6 qt. of berries at $8\frac{1}{2}$ cents.

27. 11 yd. @ $8\frac{3}{4}\text{¢}$.

24. 13 qt. of milk at $6\frac{1}{2}$ cents.

28. 14 bu. @ $10\frac{7}{8}\text{¢}$.

25. 8 lb. of lard at $12\frac{1}{2}$ cents.

29. 10 oz. @ $15\frac{1}{2}\text{¢}$.

26. 9 lb. butter at $20\frac{1}{2}$ cents.

30. 8 pt. @ $3\frac{1}{2}\text{¢}$.

31. Find the cost of 9 cans of tomatoes at $16\frac{3}{4}\text{¢}$.

32. At $\$1\frac{3}{4}$ each what will 12 books cost?

33. Find the cost of 36 yd. of carpet at $\$1\frac{1}{4}$.

34. If 5 dozen oranges cost $\$1\frac{3}{4}$, what will 20 dozen cost?

SUGGESTION. 20 is how many times 5?

35. If 6 bushels of apples cost $\$2\frac{1}{2}$, what will 18 bushels cost at the same rate?

The multiplier, a fraction; multiplicand, an integer.

1. Find $\frac{1}{3}$ of 24. Find $\frac{2}{3}$ of 24. (Since $\frac{1}{3}$ of 24 is 8, $\frac{2}{3}$ of 24 = $2 \times 8 = 16$.)

2. What is $\frac{3}{4}$ of 60?

5. Find $\frac{3}{16}$ of 32.

3. What is $\frac{5}{8}$ of 72?

6. Find $\frac{2}{3}$ of 72.

4. What is $\frac{5}{6}$ of 36?

7. Find $\frac{5}{8}$ of 64.

8. Find $\frac{2}{3}$ of 17. (Since $\frac{1}{3}$ of 17 is $1\frac{1}{3}$, then $\frac{2}{3}$ of 17 is $2 \times 1\frac{1}{3}$ or $2\frac{2}{3}$, or $11\frac{1}{3}$.)

9. Find $\frac{7}{8}$ of 21.

SOLUTION. $\frac{1}{8}$ of 21 = —; $\frac{7}{8}$ of 21 = $7 \times$ —, or —, or $18\frac{1}{2}$.

10. $\frac{3}{4}$ of 11 = —. 14. $\frac{2}{3}$ of 20 = —. 18. $\frac{5}{12}$ of 11 = —.

11. $\frac{5}{8}$ of 13 = —. 15. $\frac{4}{5}$ of 16 = —. 19. $\frac{7}{8}$ of 24 = —.

12. $\frac{7}{8}$ of 10 = —. 16. $\frac{3}{10}$ of 12 = —. 20. $\frac{3}{8}$ of 10 = —.

13. $\frac{2}{3}$ of 17 = —. 17. $\frac{4}{11}$ of 5 = —. 21. $\frac{7}{8}$ of 12 = —.

22. If you did not know the product of $4 \times \$7$, in what other way could $4 \times \$7$ be found?

23. Is it proper to say $\frac{2}{3}$ times \$6? That is, can you take \$6 $\frac{2}{3}$ times and add as in Exercise 22?

When the multiplier is a fraction, the multiplication sign (\times) should be read "of."

For convenience in writing, the exercises might have been written with the sign of multiplication instead of the word "of," but it must be read as above. Thus, $\frac{2}{3} \times \$6$ is read $\frac{2}{3}$ of \$6.

Find the product of the following:—

24. $\frac{5}{8} \times 6$. 26. $\frac{3}{11} \times 8$. 28. $\frac{3}{4} \times 16$. 30. $\frac{7}{8} \times 13$.

25. $\frac{7}{8} \times 9$. 27. $\frac{2}{3} \times 12$. 29. $\frac{2}{3} \times 21$. 31. $\frac{5}{8} \times 16$.

32. If 12 tons of bran are worth \$48, what are 8 tons worth?

SUGGESTION. 8 is what part of 12?

33. When oranges are 75 cents per dozen, what will 4 cost?

Oral and Written

1. Compare $\frac{1}{2}$ and $\frac{1}{4}$. Does increasing the number of equal parts into which a whole has been divided increase or decrease the size of the parts; that is, the size of the unit?

2. Which term shows the number of parts into which the whole thing has been divided?

3. Then, dividing the denominator by any number has what effect upon the fraction, when the numerator remains unchanged?

4. Show the relation of $\frac{7}{4}$ to $\frac{7}{2}$; of $\frac{7}{8}$ to $\frac{7}{4}$.

To find the product of a fraction and an integer, either

- I. *Multiply the numerator, or*
- II. *Divide the denominator of the fraction by the integer.*

Give the product of the following. Tell which method you use, and why.

5. $3 \times \frac{2}{5}$. 8. $5 \times \frac{2}{7}$. 11. $7 \times \frac{3}{8}$. 14. $16 \times \frac{3}{2}$.

6. $12 \times \frac{17}{4}$. 9. $11 \times \frac{5}{8}$. 12. $3 \times \frac{7}{5}$. 15. $6 \times \frac{2}{7}$.

7. $4 \times \frac{3}{8}$. 10. $6 \times \frac{11}{2}$. 13. $5 \times \frac{13}{8}$. 16. $4 \times \frac{11}{2}$.

17. When changing fractions to equivalent ones with larger units we saw that equal factors were taken from both terms. Hence, if we are to find the product of $8 \times \frac{11}{2}$, we have $\frac{88}{2}$, or 44 . Notice that the equal factors might have been taken out, or *cancelled*, before

the multiplication was performed; thus, $8 \times \frac{11}{2} = \frac{2}{12} \times \frac{11}{3} = 7\frac{1}{3}$.

18. Find $18 \times \frac{5}{7}$.

19. Find $\frac{3}{4} \times 48$.

WORK

$$\begin{array}{r} 2 \\ 18 \times \frac{5}{7} = \frac{10}{3}, \text{ or } 3\frac{1}{3} \end{array}$$

WORK

$$\frac{3}{4} \times 48 = \frac{3 \times 48}{4} = 36.$$

20. $16 \times \frac{13}{8}$.

22. $12 \times \frac{71}{44}$.

24. $\frac{5}{8} \times 24$.

21. $20 \times \frac{11}{100}$.

23. $18 \times \frac{13}{4}$.

25. $8 + 9 \times 27$.

Find the cost of the following articles:—

- | | |
|--------------------------------------|---------------------------------------|
| 1. $\frac{3}{4}$ lb. candy @ 10¢. | 6. $1\frac{1}{2}$ yd. ribbon @ 30¢. |
| 2. $\frac{2}{3}$ yd. ribbon @ 16¢. | 7. $2\frac{1}{2}$ lb. crackers @ 10¢. |
| 3. $\frac{5}{8}$ doz. oranges @ 25¢. | 8. $3\frac{1}{8}$ yd. cotton @ 10¢. |
| 4. $\frac{2}{3}$ yd. lace @ 30¢. | 9. $4\frac{1}{8}$ lb. meat @ 15¢. |
| 5. $\frac{7}{8}$ lb. butter @ 20¢. | 10. $5\frac{1}{2}$ lb. coffee @ 25¢. |

Written

11. Find the cost of 12 lb. sugar when 8 lb. cost 50¢.

SOLUTION. $12 = \frac{3}{2}$ of 8. $\frac{3}{2} \times \frac{25}{50} = 75$ ¢.

12. What is the ratio of 18 to 45? When 45 acres of land are worth \$1800, what are 18 acres of the same land worth?

13. I pay \$18 to have 20 acres of grain harvested. What does my neighbor pay at the same rate to have 50 acres harvested?

HINT. How many times 20 is 50?

14. If 17 cords sell for \$76.50, what should I pay for 68 cords?
15. Find the product of $25\frac{3}{4} \times 28$.

WORK

Find the product of the following:—

- | | | |
|-----------------------------------|---|---------------------------------|
| 28 | 16. $16 \times 18\frac{5}{8}$. ($16 \times 18\frac{5}{8} = 16 \times 18 + 16 \times \frac{5}{8}$.) | |
| <u>25$\frac{3}{4}$</u> | 17. $17\frac{2}{3} \times 22$. | 22. $18\frac{3}{4} \times 72$. |
| 4)84 | 18. $26\frac{7}{8} \times 84$. | 23. $16\frac{1}{2} \times 87$. |
| 21 = $\frac{3}{4} \times 28$ | 19. $32 \times 66\frac{2}{3}$. | 24. $15 \times 30\frac{1}{4}$. |
| 140 = 5×28 | 20. $33\frac{1}{3} \times 50$. | 25. $16\frac{4}{5} \times 51$. |
| 560 = 20×28 | 21. $25 \times 87\frac{1}{2}$. | 26. $37 \times 85\frac{1}{4}$. |
| 721 = $25\frac{3}{4} \times 28$ | | |

Find the cost of the following articles:—

- | | |
|--|---|
| 27. $16\frac{2}{3}$ yd. cloth @ \$2.75. | 30. 42 books @ \$.53 $\frac{1}{4}$. |
| 28. 64 yd. braid @ \$.31 $\frac{1}{8}$. | 31. 95 $\frac{7}{8}$ lb. tea @ \$.32. |
| 29. $18\frac{3}{8}$ lb. butter @ \$.25. | 32. $16\frac{3}{8}$ tons coal @ \$7.25. |

1. What will 17 lb. of coffee cost at $\$0.58\frac{1}{2}$ a pound?
2. How many square inches in a rectangle 24 in. long and $18\frac{1}{2}$ in. wide? How many square inches in 1 strip 1 in. wide and $18\frac{1}{2}$ in. long? How many such strips?
3. Find the cost of $18\frac{1}{2}$ tons of coal at $\$7.50$ per ton.
4. Find the perimeter of a square $17\frac{1}{2}$ inches long.
5. Find the perimeter of a room $24\frac{1}{2}$ feet long and $19\frac{1}{2}$ feet wide.
6. If a man can travel $42\frac{1}{2}$ miles in 3 days, how far can he travel in 36 days?
7. Find the cost of $8\frac{1}{2}$ tons of hay at $\$9$ a ton.

Find the amount of the following bills:—

- | | |
|---|---|
| 8. $16\frac{3}{4}$ yd. cloth @ $\$2.75$. | 9. $7\frac{1}{2}$ tons hay @ $\$9.50$. |
| 48 yd. lining @ $0.31\frac{1}{2}$. | $2\frac{1}{2}$ tons feed @ 12.00 . |
| $18\frac{1}{2}$ doz. buttons @ 0.28 . | 20 bu. oats @ $0.31\frac{1}{2}$. |
10. From a piece of carpet 56 yd. long, $32\frac{1}{2}$ yd. were sold at 90¢, and the remainder at 80¢. How much was received for the whole?
 11. If a man can cut $2\frac{1}{2}$ cords of wood in one day, how much can he cut in 16 days?
 12. How much can he earn in 12 days, if he receives 60¢ a cord for cutting it?
 13. If a horse eats $3\frac{1}{2}$ qt. of oats in one day, how much will he eat in 30 days?
 14. What will the oats for 30 days cost at $48\frac{1}{2}$ ¢ a bushel?
 15. Add $5 \times 6\frac{3}{4}$ to $7\frac{3}{4} \times 7$.

Find the amount of the following bills:—

- | | |
|--|---|
| 16. $3\frac{1}{2}$ yd. ribbon @ $12\frac{1}{2}$ ¢. | 17. $12\frac{1}{2}$ lb. sugar @ $7\frac{1}{2}$ ¢. |
| $10\frac{3}{4}$ yd. cotton @ $8\frac{1}{2}$ ¢. | $2\frac{1}{2}$ lb. butter @ $24\frac{1}{2}$ ¢. |
| $12\frac{1}{2}$ yd. tape @ $3\frac{1}{2}$ ¢. | $8\frac{1}{2}$ lb. lard @ $16\frac{1}{2}$ ¢. |

1. What is the first step to be taken in adding $1\frac{1}{6}$ and $7\frac{7}{12}$? What is the common unit?

2. Add $7\frac{7}{6}$ to $1\frac{1}{6}$ and subtract from $4\frac{3}{6} + 1\frac{3}{6}$.

3. $32\frac{3}{8} + 17\frac{3}{8} + 6\frac{1}{8}$ = what?

4. At \$1 a rod, what will 3 days' work, or $6\frac{3}{4}$ rd., $5\frac{3}{4}$ rd., and $7\frac{5}{8}$ rd., cost?

5. What added to $17\frac{9}{10}$ gives $29\frac{1}{10}$?

Find the product by increasing the size of the units: —

6. $6 \times 7\frac{7}{12}$.

9. $10 \times 7\frac{7}{6}$.

12. $15 \times 7\frac{7}{6}$.

7. $8 \times 4\frac{3}{8}$.

10. $12 \times 4\frac{3}{8}$ yd.

13. $25 \times 4\frac{3}{8}$.

8. $3 \times 4\frac{1}{4}$.

11. $18 \times 4\frac{1}{4}$ mi.

14. $36 \times 4\frac{1}{4}$.

15. In finding $\frac{1}{4}$ of \$8 to be \$2, do we multiply or divide?

16. $\frac{2}{3}$ of 6 years (or $2 \times \frac{1}{3}$ of 6 years) is 4 years. What part of the multiplicand has been taken? What does multiplying by $\frac{2}{3}$ mean?

17. $\frac{3}{8}$ of 24 hr. 21. $\frac{5}{7}$ of 30 = $5 \times 4\frac{2}{7} = 20\frac{10}{7} = 21\frac{3}{7}$. Explain.

18. $\frac{7}{9}$ of 36 in. 22. $\frac{5}{7}$ of 30 = $\frac{5 \times 30}{7} = \frac{150}{7} = 21\frac{3}{7}$. Explain.

19. $1\frac{1}{2}$ of 84 mo.

23. $\frac{8}{9}$ of 30.

25. $1\frac{1}{2}$ of \$100.

20. $\frac{9}{15}$ of 60 da.

24. $7\frac{7}{12}$ of 50.

26. $\frac{5}{8}$ of 120.

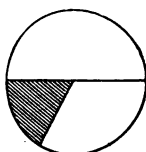
27. Find the cost of $18\frac{3}{8}$ cords of wood at \$8.40 per cord.

28. What is the weight of 18 bags of coffee weighing $38\frac{3}{8}$ lb. each?

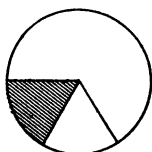
29. At $18\frac{3}{8}$ lb. of sugar for \$1, how much will \$16 buy?

30. At $5\frac{5}{12}$ miles per hour, how far can a boat travel in 24 hr.?

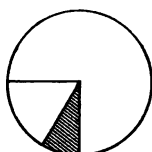
31. A man lost $\frac{3}{8}$ of his investment of \$728 in a speculation. How much remained?



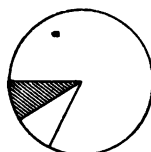
$$\frac{1}{3} \text{ of } \frac{1}{2} = \frac{1}{6}$$



$$\frac{1}{2} \text{ of } \frac{1}{3} = \frac{1}{6}$$



$$\frac{1}{3} \text{ of } \frac{1}{4} = \frac{1}{12}$$



$$\frac{1}{2} \text{ of } \frac{1}{6} = \frac{1}{12}$$

1. Divide $\frac{1}{2}$ a circle by 3; that is, find $\frac{1}{3}$ of $\frac{1}{2}$ a circle.

Remember that to divide by 3 may mean to separate whatever is divided — a number, a whole thing, or a part of a thing — into 3 equal parts.

2. Observe in the circles what it is to divide $\frac{1}{3}$ by 2; $\frac{1}{4}$ by 3; $\frac{1}{6}$ by 2.

3. Draw oblongs or circles, to show what $\frac{1}{2}$ of $\frac{1}{4}$ is; to show $\frac{1}{4}$ of $\frac{1}{3}$; to show $\frac{1}{3}$ of $\frac{1}{6}$.

4. When you divide the 4ths into 2 equal parts, what is the size of the fractional unit obtained?

5. When you divide 8ths into 3 equal parts, what is the unit?

6. What unit will you have when you divide 6ths into 5 equal parts?

7. What does it mean to find $\frac{3}{4}$ of 8? $\frac{3}{5}$ of 10?

8. What is it to find $\frac{2}{3}$ of $\frac{4}{5}$ of a thing?

9. Find $\frac{2}{3}$ of $\frac{4}{5}$.

SUGGESTIONS. $\frac{4}{5}$ divided into 3 equal parts, that is $\frac{1}{3}$ of $\frac{4}{5}$ is $\frac{4}{15}$, for 5ths divided into 3 equal parts are 15ths. Now since $\frac{2}{3}$ of anything means to divide into 3 equal parts and take 2 of these parts, we are to take $2 \times \frac{4}{15}$, which are $\frac{8}{15}$.

10. Find $\frac{3}{4}$ of $\frac{1}{2}$.

13. $\frac{3}{4}$ of $\frac{4}{5} = \text{---}$.

16. $\frac{3}{4}$ of $\frac{3}{4} = ?$

11. What is $\frac{3}{4}$ of $\frac{3}{4}$?

14. $\frac{1}{3}$ of $\frac{5}{8} = \text{---}$.

17. $\frac{2}{3}$ of $\frac{5}{7} = ?$

12. What is $\frac{3}{4}$ of $\frac{5}{8}$?

15. $\frac{3}{4}$ of $\frac{3}{7} = \text{---}$.

18. $\frac{2}{3}$ of $\frac{5}{8} = ?$

19. What is $\frac{3}{4}$ of $\frac{7}{8}$? $\frac{2}{3}$ of $\frac{7}{8}$? $\frac{5}{8}$ of $\frac{3}{15}$? $\frac{3}{4}$ of $\frac{7}{8}$? $\frac{2}{3}$ of $\frac{5}{18}$?

Instead of speaking of finding a fractional part of a fraction, we call the process of finding $\frac{2}{3}$ of $\frac{3}{4}$ multiplication, and use the sign of multiplication, which is always read "of" in such examples.

1. Multiply $\frac{2}{3}$ by $\frac{3}{4}$; that is, find $\frac{2}{3}$ of $\frac{3}{4}$ or $\frac{2}{3} \times \frac{3}{4}$.

This means that we are to divide the $\frac{3}{4}$ into 5 equal parts and take 4 of these parts. $\frac{1}{5}$ of $\frac{3}{4} = \frac{3}{20}$; $4 \times \frac{3}{20} = \frac{12}{20}$.

Observe that *the product of the two fractions is a fraction whose numerator is the product of the numerators, and whose denominator is the product of the denominators of the factors.*

Since the product should be reduced to largest units by dividing both terms by the common factors, this may be done before multiplying, and the work shortened. This process is called **cancellation**.

WORK

2. Find $\frac{4}{7} \times \frac{7}{16}$.

$$\frac{4}{7} \times \frac{7}{16} = \frac{1}{4}$$

In this way find:—

3. $\frac{2}{3} \times \frac{1}{2}$.

7. $\frac{5}{8} \times \frac{2}{3}$.

11. $\frac{2}{3} \times \frac{5}{7} \times \frac{7}{10}$.

4. $\frac{3}{4} \times \frac{7}{9}$.

8. $\frac{1}{3} \times \frac{3}{4}$.

12. $\frac{1}{4} \times \frac{4}{5} \times \frac{5}{7}$.

5. $\frac{5}{10} \times \frac{2}{3}$.

9. $\frac{3}{4} \times \frac{1}{2}$.

13. $\frac{5}{7} \times \frac{5}{8} \times \frac{7}{10}$.

6. $\frac{5}{8} \times \frac{3}{10}$.

10. $\frac{7}{8} \times \frac{4}{11}$.

14. $\frac{7}{8} \times \frac{2}{3} \times \frac{3}{5}$.

Remark. *In multiplication mixed numbers may be changed to improper fractions.*

15. $2\frac{2}{3} \times 1\frac{1}{2}$.

18. $6\frac{1}{4} \times 3\frac{3}{8}$.

21. $6\frac{4}{5} \times 1\frac{1}{10}$.

16. $\frac{4}{5} \times 7\frac{1}{2}$.

19. $6\frac{7}{8} \times 9\frac{3}{8}$.

22. $8\frac{2}{3} \times 7\frac{1}{7}$.

17. $\frac{7}{8} \times 5\frac{1}{8}$.

20. $15\frac{2}{3} \times 5\frac{1}{11}$.

23. $5\frac{1}{2} \times 5\frac{1}{2}$.

24. What will $17\frac{1}{2}$ bu. of corn cost when one bushel costs $51\frac{1}{2}$ ¢?

25. What will pay for $27\frac{1}{2}$ yards at $6\frac{1}{2}$ ¢?

1. $7\frac{1}{2}$ lb. of sugar are in 2 packages; one weighs $2\frac{1}{2}$ lb. What does the other weigh?

2. Show that 16 is $\frac{2}{3}$ of 24. 30 is what part of 36?

3. What is the ratio of 24 to 56? Of 18 to 54? Of 27 to 45?

What shall I pay for

4. $2\frac{1}{2}$ lb. rice @ 8¢?

5. 6 yd. cotton @ $10\frac{3}{4}$ ¢?

$1\frac{1}{2}$ lb. butter @ 20¢?

5 doz. buttons @ $12\frac{1}{2}$ ¢?

6. A man who is halfway home has $4\frac{1}{2}$ miles to travel. How far away from home has he been?

7. Mary had $\frac{1}{2}$ of her words right, and Florence had $\frac{1}{3}$ of hers wrong. Which missed the more?

8. After selling $\frac{5}{8}$ of his papers a newsboy had 12 left. How many did he sell?

9. Add $\frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \frac{1}{5}$.

10. $10 - \frac{2}{3} - \frac{2}{3} - \frac{2}{3} - \frac{2}{3} = \text{---}$.

11. If 2 cords of wood cost \$7 $\frac{3}{4}$, what will 8 cords cost?

12. If $3\frac{1}{2}$ dozen eggs are sold for 70 cents, what shall I pay for 7 dozen?

13. Compare $\frac{3}{4}$ and 2.

SUGGESTION. $2 = \text{---}$ $\frac{3}{4}$ is what part of $\frac{3}{4}$? $\frac{3}{4}$ is how many times $\frac{3}{4}$?

14. What is the ratio of $2\frac{1}{2}$ to 5? Of $3\frac{1}{2}$ to 7?

15. Make problems in which you can make use of the ratios of $2\frac{1}{2}$ to 5 and $3\frac{1}{2}$ to 7. SUGGESTION. See Ex. 11.

16. What is the ratio of 24 to 36? Of $3\frac{1}{2}$ to 10? Of 18 to 45?

17. Make problems similar to Ex. 11 in which you can use the ratios of Ex. 16.

18. How many quarts in 16 jars holding $\frac{3}{4}$ of a pint each?

19. Draw an oblong $2\frac{1}{2}$ inches long and $1\frac{1}{4}$ inches wide, and find the perimeter and area.

20. If one box holds $2\frac{3}{4}$ cu. in., what will 6 such boxes hold?

1. If 36 qt. of berries cost \$3.00, what will 24 qt. cost?

SUGGESTION. What is the ratio of 24 to 36? What part, then, of \$3.00 will 24 qt. cost?

2. If it cost \$36 to carpet a room 18 feet long and 12 feet wide, what will it cost to carpet a room 15 feet long and 12 feet wide with the same kind of carpet?

(**HINT.** Compare the areas or the lengths.)

3. My horse cost \$96, and a cow $\frac{7}{8}$ as much. What did both cost?

4. How will the cost of 56 bushels of wheat compare with the cost of 84 bushels?

5. At $\frac{3}{4}$ of a cent a square foot, what will it cost to paint a black-board 20 feet long and $4\frac{1}{2}$ feet wide?

Give the amount of my bill if I buy—

- | | |
|--------------------------------------|---|
| 6. $7\frac{3}{8}$ lb. sirloin @ 18¢. | 7. $3\frac{3}{8}$ yd. silk @ \$0.62 $\frac{1}{2}$. |
| $\frac{3}{4}$ lb. tea @ 75¢. | $\frac{3}{4}$ yd. fringe @ \$2 $\frac{1}{4}$. |
| 6 lb. coffee @ 28 $\frac{3}{4}$ ¢. | 2 $\frac{7}{8}$ doz. buttons @ \$0.20. |

8. My horse cost me \$120; $\frac{4}{5}$ of the cost of my horse is $\frac{1}{2}$ of the cost of my carriage. Find the cost of the carriage.

9. A square rod is a square one rod, or $16\frac{1}{2}$ feet, long. How many square feet does it contain?

10. How many yards in $16\frac{1}{2}$ feet? In $82\frac{1}{2}$ feet?

11. A checkerboard contains 64 squares each $\frac{7}{8}$ of an inch long. What is the area of the board?

12. If you erase $\frac{7}{10}$ of a line $2\frac{1}{2}$ feet long, what will be the length of the remainder?

13. If silver is worth \$0.70 an ounce, what are 2000 pounds worth? (Consider 12 oz. = 1 lb.)

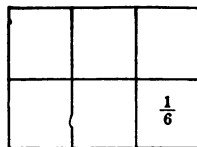
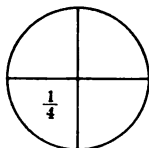
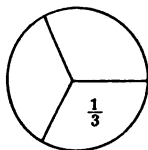
Find the values of:—

14. $204\frac{7}{8} - 93\frac{1}{4}$.

16. $1\frac{2}{3} + 4\frac{1}{3}$.

15. $8\frac{2}{5} \times 2\frac{1}{3}$.

17. $\frac{7}{8}$ of $\frac{1}{11} + \frac{5}{12}$ of $\frac{1}{18}$.



1. How many *thirds* of a circle in one circle? $1 \div \frac{1}{3} = \text{---}$.
2. How many *fourths* of a circle in one circle? $1 \div \frac{1}{4} = \text{---}$.
3. $1 \div \frac{1}{6} = \text{---}$. $\frac{3}{4} \div \frac{1}{4} = \text{---}$. $\frac{5}{6} \div \frac{1}{6} = \text{---}$.
4. How many $\$ \frac{1}{2}$ in $\$1$? In $\$2$? In $\$3$?
5. $2 \div \frac{1}{4} = \text{---}$. $3 \div \frac{1}{4} = \text{---}$. $2 \div \frac{1}{6} = \text{---}$. $3 \div \frac{1}{6} = \text{---}$.
6. How many times is 6 inches contained in 3 feet? What change did you make before dividing?

7. 3 pints is contained how many times in 3 gallons? What did you do before dividing?

8. How many times is $\frac{3}{4}$ contained in 1, or $\frac{4}{4}$?

SUGGESTION. From the circle notice that $\frac{3}{4}$ is contained in 1, or $\frac{4}{4}$, 1 time, with $\frac{1}{4}$ of the circle remaining; but $\frac{1}{4}$ is $\frac{1}{3}$ of $\frac{3}{4}$, hence $1 \div \frac{3}{4} = 1\frac{1}{3}$ or $\frac{4}{3}$.

9. How many times is $\frac{2}{3}$ contained in 1? $1 \div \frac{2}{3} = \text{---}$.

SUGGESTION. 6 sixths \div 5 sixths = $\frac{6}{5}$.

10. $1 \div \frac{2}{7} = \text{---}$. $1 \div \frac{3}{8} = \text{---}$. $1 \div \frac{2}{9} = \text{---}$. $1 \div \frac{3}{10} = \text{---}$.

11. How does the quotient of $1 \div \frac{3}{8}$ compare with $2 \div \frac{3}{8}$?

12. How does 1 foot \div 3 inches compare with 2 feet \div 3 inches?

13. Since $1 \div \frac{3}{8} = \frac{8}{3}$, $2 \div \frac{3}{8} = \frac{16}{3}$; $3 \div \frac{3}{8} = \frac{24}{3}$; $4 \div \frac{3}{8} = \frac{32}{3}$.

14. How many times is $\frac{3}{8}$ contained in 5? In 6? In 8?

15. Divide 3 by $\frac{5}{8}$. HINT. What is $1 \div \frac{5}{8}$?

16. Find the quotient of $6 \div \frac{2}{3}$. Of $7 \div \frac{2}{3}$. Of $12 \div \frac{2}{3}$.

17. $10 \div \frac{3}{8} = \text{---}$. $12 \div \frac{2}{7} = \text{---}$. $8 \div \frac{2}{3} = \text{---}$. $9 \div \frac{3}{4} = \text{---}$.

18. $6 \div \frac{2}{7}$. 20. $12 \div \frac{3}{8}$. 22. $15 \div \frac{3}{4}$. 24. $7 \div \frac{5}{6}$.

19. $7 \div \frac{3}{8}$. 21. $10 \div \frac{2}{3}$. 23. $11 \div \frac{3}{4}$. 25. $9 \div \frac{4}{5}$.

1. How many times is $\frac{5}{8}$ contained in $4\frac{5}{8}$?

SUGGESTION. $4\frac{5}{8} = \frac{37}{8}$; $\frac{37}{8} \div \frac{5}{8} = \text{---}$.

2. How many times is $\frac{2}{3}$ contained in $3\frac{1}{3}$? $\frac{3}{4}$ in $5\frac{1}{4}$?

3. How many times is $\frac{5}{8}$ contained in $2\frac{1}{8}$? $\frac{2}{3}$ in $7\frac{1}{3}$?

4. What is the quotient of $3\frac{1}{4} \div \frac{3}{4}$? Of $6\frac{1}{2} \div \frac{5}{8}$?

5. What is the quotient of $4\frac{1}{2} \div \frac{5}{8}$? Of $5\frac{7}{8} \div \frac{3}{4}$?

6. Divide $6\frac{2}{3}$ by $\frac{2}{3}$; $8\frac{1}{2}$ by $\frac{4}{5}$; $6\frac{1}{2}$ by $\frac{3}{4}$.

7. How many times is $3\frac{1}{3}$ contained in $7\frac{2}{3}$?

8. How many times is $2\frac{1}{3}$ contained in $5\frac{2}{3}$? $3\frac{1}{2}$ in $7\frac{1}{2}$?

Give the following quotients:—

9. $6\frac{3}{4} \div 3\frac{1}{4}$.

13. $6\frac{2}{3} \div 5\frac{1}{3}$.

17. $2\frac{3}{4} \div 1\frac{1}{4}$.

10. $7\frac{4}{5} \div 2\frac{1}{5}$.

14. $12\frac{2}{3} \div 6\frac{2}{3}$.

18. $16\frac{1}{2} \div 7\frac{1}{2}$.

11. $9\frac{1}{2} \div 5\frac{1}{2}$.

15. $15\frac{1}{4} \div 6\frac{3}{4}$.

19. $3\frac{1}{6} \div 2\frac{5}{6}$.

12. $8\frac{3}{4} \div 1\frac{3}{4}$.

16. $7\frac{2}{3} \div 3\frac{1}{3}$.

20. $7\frac{7}{8} \div 1\frac{1}{8}$.

21. How does the quotient of $8 \div 2$ compare with the quotient of $4 \div 2$?

22. How does the quotient of $1 \div \frac{2}{3}$ compare with $\frac{1}{2} \div \frac{2}{3}$?

23. What is $1 \div \frac{2}{3}$, that is, $\frac{3}{2} \div \frac{2}{3}$? What, then, is $\frac{1}{2} \div \frac{2}{3}$?

24. Find $\frac{1}{2} \div \frac{2}{3}$ by changing both to like units.

25. Find $\frac{2}{3} \div \frac{3}{4}$ by changing both to like units.

26. Divide $\frac{7}{8}$ by $\frac{3}{4}$; $\frac{8}{9}$ by $\frac{2}{3}$; $\frac{15}{16}$ by $\frac{3}{8}$; $\frac{1}{2}$ by $\frac{5}{8}$; $\frac{1}{3}$ by $\frac{8}{9}$.

27. Divide $\frac{3}{4}$ by $\frac{3}{8}$; $\frac{5}{6} \div \frac{1}{12} = \text{---}$; $\frac{1}{3} \div \frac{4}{5} = \text{---}$; $\frac{5}{6} \div \frac{7}{12} = \text{---}$

Give the following quotients:—

28. $\frac{3}{4} \div \frac{3}{8}$.

32. $\frac{2}{3} \div \frac{3}{4}$.

36. $\frac{4}{5} \div \frac{3}{4}$.

40. $\frac{2}{3} \div \frac{2}{5}$.

29. $\frac{3}{5} \div \frac{2}{15}$.

33. $\frac{2}{6} \div \frac{2}{3}$.

37. $\frac{5}{8} \div \frac{2}{3}$.

41. $\frac{2}{16} \div \frac{3}{8}$.

30. $\frac{7}{8} \div \frac{1}{2}$.

34. $\frac{3}{8} \div \frac{2}{3}$.

38. $\frac{2}{3} \div \frac{5}{8}$.

42. $\frac{7}{8} \div \frac{5}{6}$.

31. $\frac{2}{3} \div \frac{7}{12}$.

35. $\frac{1}{4} \div \frac{1}{3}$.

39. $\frac{5}{7} \div \frac{9}{14}$.

43. $\frac{7}{8} \div \frac{3}{2}$.

I. *The Dividend Fractional.*

1. Divide
- $762\frac{1}{2}$
- by 8.

WORK

$$\begin{array}{r} 8 \overline{) 762\frac{1}{2}} \\ 95\frac{7}{8}, \text{ Ans.} \end{array}$$

EXPLANATION. $\frac{1}{2}$ of $762\frac{1}{2} = 95$ and a remainder of $2\frac{1}{2}$; $\frac{1}{2}$ of $2\frac{1}{2} = \frac{7}{8}$.

2. Find the value of
- $562\frac{1}{2} \div 7$
- .

5. Find
- $682\frac{1}{2} \div 9$
- .

3. Divide
- $381\frac{1}{2}$
- by 5.

6. Divide
- $349\frac{1}{2}$
- by 8.

4. Divide
- $429\frac{3}{8}$
- by 6.

7. Divide
- $294\frac{1}{2}$
- by 12.

WORK

8. Divide
- $372\frac{3}{4}$
- by 15.

$$\begin{array}{r} 15 \overline{) 372\frac{3}{4}} \\ 3 \quad 3 \\ \hline 45 \overline{) 1118(24\frac{1}{4}} \end{array}$$

EXPLANATION. We first changed both dividend and divisor to 3ds, and then used the numerators.

$$\begin{array}{r} 90 \\ \hline 218 \\ \hline 180 \\ \hline \frac{1}{4} \text{ of } 38 = \frac{1}{4} \end{array}$$

9. $297\frac{3}{4} \div 16$.

12. $764\frac{1}{2} \div 19$.

10. $346\frac{3}{8} \div 21$.

13. $847\frac{3}{8} \div 30$.

11. $849\frac{5}{8} \div 24$.

14. $946\frac{7}{8} \div 43$.

II. *The Divisor Fractional.*

15. How many times is
- $16\frac{2}{3}$
- contained in 565?

HINT. Change both dividend and divisor to 3ds.

16. $275 \div 33\frac{1}{3}$.

18. $625 \div 17\frac{2}{3}$.

20. $846 \div 94\frac{1}{3}$.

17. $181 \div 15\frac{2}{3}$.

19. $291 \div 27\frac{1}{3}$.

21. $933 \div 72\frac{1}{3}$.

22. If 63 sofas cost \$925
- $\frac{1}{2}$
- , what will one cost?

23. When a train runs
- $873\frac{5}{12}$
- miles in 25 hours, how far does it run in one hour?

24. What is
- $\frac{1}{4}$
- of
- $7864\frac{7}{10}$
- tons?

- 25.
- $16\frac{1}{2}$
- feet = 1 rod. How many rods and feet are there in 800 feet? (
- Caution.*
- The remainder is always like the dividend. When one is half-foot, the other is half-foot.)

26. Change 975 feet to rods and feet.

1. How many times is $\frac{4}{5}$ contained in $\frac{3}{5}$?

SUGGESTION. Change to like units.

2. How many times is $\frac{2}{3}$ contained in $\frac{5}{7}$?

Divide:—

- | | | |
|--------------------------------------|--|--|
| 3. $\frac{1}{11}$ by $\frac{3}{8}$. | 7. $\frac{1}{10}$ by $\frac{2}{3}$. | 11. $\frac{2}{18}$ by $\frac{5}{7}$. |
| 4. $\frac{1}{14}$ by $\frac{5}{8}$. | 8. $\frac{1}{11}$ by $\frac{3}{8}$. | 12. $\frac{1}{20}$ by $\frac{5}{8}$. |
| 5. $\frac{1}{10}$ by $\frac{2}{3}$. | 9. $\frac{1}{10}$ by $\frac{2}{3}$. | 13. $\frac{1}{18}$ by $\frac{2}{27}$. |
| 6. $\frac{1}{10}$ by $\frac{2}{7}$. | 10. $\frac{5}{21}$ by $\frac{2}{11}$. | 14. $\frac{1}{10}$ by $\frac{2}{10}$. |

Oral

15. How many times is $\frac{1}{3}$ contained in 1? in 2? in 3?
16. Divide 1 foot by 2 inches. Divide $\frac{5}{8}$ of a foot by 2 inches.
17. What is the relation of the quotient of $\frac{5}{8}$ of a foot divided by 2 inches, and 1 foot divided by 2 inches?
18. What is the relation of $\frac{5}{8} \div \frac{2}{3}$ to $1 \div \frac{2}{3}$?
19. By comparison with $1 \div \frac{2}{3}$, find $\frac{5}{8} \div \frac{2}{3}$.
- We first think $1 \div \frac{2}{3}$, or $\frac{3}{2} \div \frac{2}{3} = \frac{9}{4}$, then $\frac{5}{8} \div \frac{2}{3} = \frac{5}{8}$ of $\frac{9}{4} = \frac{15}{16}$ or $\frac{5}{4}$.
20. In this way find $\frac{2}{3} \div \frac{1}{2}$; $\frac{2}{3} \div \frac{1}{4}$; $\frac{1}{4} \div \frac{2}{3}$; $\frac{2}{3} \div \frac{3}{4}$.

Give the following quotients:—

- | | | | |
|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|
| 21. $\frac{2}{3} \div \frac{2}{3}$. | 24. $\frac{2}{7} \div \frac{2}{3}$. | 27. $\frac{2}{7} \div \frac{1}{3}$. | 30. $\frac{2}{9} \div \frac{1}{5}$. |
| 22. $\frac{3}{4} \div \frac{2}{3}$. | 25. $\frac{1}{8} \div \frac{5}{8}$. | 28. $\frac{5}{8} \div \frac{4}{5}$. | 31. $\frac{5}{7} \div \frac{4}{5}$. |
| 23. $\frac{2}{3} \div \frac{3}{8}$. | 26. $\frac{3}{8} \div \frac{2}{3}$. | 29. $\frac{7}{8} \div \frac{1}{4}$. | 32. $\frac{7}{8} \div \frac{2}{3}$. |

33. How many yards of lace at $\$ \frac{7}{8}$ can be bought for $\$ 3\frac{1}{2}$?

34. Ribbon at $\$ \frac{3}{8}$ a yard cost $\$ 3$; how many yards did I buy?

35. Divide $\frac{3}{17}$ by $\frac{2}{51}$.

36. Divide $\frac{3}{8}$ by $\frac{2}{3}$.

37. Which method did you use in Ex. 35 and 36? Why?

NOTE. When both units may be made alike by changing but one, as in Ex. 35, it is shorter to change to like units.

1. Divide $1\frac{3}{8}$ by $\frac{3}{8}$. Since you can tell at sight that the quotient of 1 or $\frac{8}{8}$ divided by $\frac{3}{8}$ is $\frac{8}{3}$, and since you know that the quotient of $1\frac{3}{8} \div \frac{3}{8}$ will be $1\frac{3}{8}$ of this quotient, you need write simply $1\frac{3}{8} \div \frac{3}{8} = 1\frac{3}{8}$ of $\frac{8}{3} = 1\frac{1}{3}$. Notice that this is shorter than changing both fractions to 144ths.

Find the following. Which method do you prefer? Why?

2. $\frac{3}{8} \div \frac{7}{8}$.

6. $1\frac{3}{2} \div \frac{7}{6}$.

10. $1\frac{7}{8} \div \frac{3}{8}$.

14. $1\frac{6}{8} \div \frac{2}{8}$.

3. $\frac{5}{7} \div \frac{3}{8}$.

7. $\frac{7}{2} \div 1\frac{1}{4}$.

11. $\frac{7}{8} \div \frac{3}{8}$.

15. $1\frac{5}{2} \div 1\frac{1}{8}$.

4. $\frac{7}{3} \div 1\frac{1}{11}$.

8. $1\frac{3}{8} \div \frac{5}{8}$.

12. $\frac{8}{9} \div \frac{5}{7}$.

16. $1\frac{8}{8} \div \frac{2}{7}$.

5. $1\frac{9}{4} \div \frac{7}{8}$.

9. $1\frac{3}{6} \div \frac{5}{8}$.

13. $\frac{5}{27} \div 1\frac{5}{8}$.

17. $\frac{9}{17} \div 1\frac{1}{11}$.

18. Find those that you can solve orally in the exercises above. Which method did you use?

19. How many times is $\frac{3}{8}$ contained in $3\frac{3}{8}$?

20. What is the quotient of $2\frac{5}{9}$ divided by $\frac{2}{3}$?

21. I paid \$135 $\frac{3}{4}$ for coal at \$7 $\frac{1}{2}$ a ton. How many tons did I buy?

22. How many barrels, each containing $2\frac{3}{4}$ bushels, can be filled from 221 bushels of apples?

23. How many loads, each containing $3\frac{1}{4}$ cords, in 186 cords of wood?

Find the quotient of:—

24. $\frac{2}{5} \div 1\frac{1}{8}$.

28. $4\frac{1}{2} \div 2\frac{1}{2}$.

32. $87\frac{1}{2} \div 12\frac{1}{2}$.

25. $\frac{5}{2} \div \frac{5}{4}$.

29. $9\frac{1}{3} \div 1\frac{1}{3}$.

33. $62\frac{1}{2} \div 37\frac{1}{2}$.

26. $3\frac{1}{2} \div 2\frac{1}{2}$.

30. $33 \div 6\frac{1}{2}$.

34. $30\frac{1}{4} \div 5\frac{1}{2}$.

27. $6\frac{2}{5} \div 2\frac{3}{5}$.

31. $66\frac{2}{3} \div 16\frac{2}{3}$.

35. $272\frac{1}{4} \div 16\frac{1}{2}$.

1. 6 is $\frac{1}{2}$ of —; 8 is — of 24; — is $\frac{1}{4}$ of 36.
2. 5 is — of 15; 6 is — of 30; — is $\frac{1}{4}$ of 28.
3. What part of 16 is 8? Of 36 is 9? Of 32 is 4?
4. What is the ratio of 16 to 8? Of 8 to 16?
5. Compare 4 and 16. 4 is — of 16; 16 is — times 4.
6. Compare 28 and 7; 18 and 6.
7. 3 is — of 9, — of 12, and $\frac{1}{3}$ of —.
8. What number is $\frac{3}{5}$ of 5? What is the ratio of 3 to 5?
9. 3 is what part of 8? Of 7? Of 10?
10. What kind of fraction is the quotient, when the divisor is larger than the dividend?
11. Compare 10 and 15.
SUGGESTION. $10 = 2$ times 5, and $15 = 3$ times 5, hence their ratio is the ratio of 2 to 3 or —.
12. In the same way, find the ratio of 10 to 15. Of 10 to 35.
13. What is the ratio of 16 to 24? Of 16 to 40? Of 16 to 56?
14. What is the ratio of 20 to 30? Of 20 to 50? Of 20 to 90?
15. What is the ratio of 18 to 24? Of 18 to 36? Of 18 to 45?
16. Compare 15 and 25. 15 is — of 25. 25 is — times 15.

Give the following ratios: —

- | | | |
|--|---------------------------------------|--|
| 17. $\frac{3}{8}$ to $\frac{5}{8}$. | 21. $\frac{2}{5}$ to $3\frac{1}{5}$. | 25. $1\frac{1}{2}$ to $2\frac{3}{4}$. |
| 18. $\frac{2}{3}$ to $\frac{7}{3}$. | 22. $\frac{3}{8}$ to $1\frac{7}{8}$. | 26. $1\frac{1}{2}$ to $7\frac{1}{2}$. |
| 19. 3 ft. to 9 ft. | 23. $\frac{5}{8}$ to $3\frac{1}{8}$. | 27. $2\frac{1}{4}$ to 9. |
| 20. 8 qt. to 24 qt. | 24. $\frac{2}{7}$ to $1\frac{5}{7}$. | 28. $2\frac{1}{8}$ to $4\frac{1}{8}$. |
| 29. If 8 qt. of berries cost \$0.92, what will 24 qt. cost? | | |
| 30. If $1\frac{1}{2}$ cords of wood cost \$9, what will $7\frac{1}{2}$ cords cost? | | |

HINT. $7\frac{1}{2}$ is — times $1\frac{1}{2}$.

1. Into how many pieces $\frac{3}{4}$ of a yard long can 24 yards of ribbon be cut?
2. How many times can I fill a pail holding $1\frac{1}{2}$ gallons from a tank containing $14\frac{1}{2}$ gallons?
3. I have \$12 $\frac{1}{2}$, \$2 $\frac{1}{2}$ of which is silver. What part of my money is in silver?
4. How many times is $3\frac{1}{2}$ contained in 42?
5. How many times is $2\frac{1}{8}$ contained in 23?
6. What part of $4\frac{1}{12}$ lb. is $3\frac{1}{2}$ lb.? What is the ratio of $3\frac{1}{2}$ to $4\frac{1}{12}$?
7. What is the ratio of $4\frac{1}{8}$ sq. in. to 13 sq. in.?
8. What part of a foot rule remains after $2\frac{1}{2}$ inches have been cut off?
9. What is the ratio of $3\frac{1}{8}$ to $33\frac{1}{8}$? Of $6\frac{2}{3}$ to $66\frac{2}{3}$?
10. What is the ratio of $12\frac{1}{2}$ to 100? Of $37\frac{1}{2}$ to 100?
11. How many breadths of carpet $\frac{2}{3}$ of a yard in width will be needed for a room 18 ft. wide?
12. Compare the width and length of a blackboard measuring $3\frac{1}{4}$ ft. by 20 ft.
13. What part of a dollar is $31\frac{1}{4}\%$?
14. What is $\frac{5}{8}$ of $12\frac{3}{4}$ hours?
15. Divide the product of $3\frac{1}{8}$ and $4\frac{2}{5}$ by $2\frac{1}{2}$.
16. How many times is $\frac{7}{8}$ of $21\frac{3}{4}$ contained in $\frac{1}{2}$ of $43\frac{1}{2}$?
17. How many bars of soap in a box weighing 200 lb., if one bar weighs $1\frac{1}{8}$ lb.?
18. Reduce 243 ft. to rods and a fraction of a rod.
19. Divide $\frac{2}{3}$ of $\frac{5}{8}$ by $\frac{2}{3}$ of $\frac{7}{8}$.
20. Divide 612 by $37\frac{1}{2}$.
21. Divide 1728 by $272\frac{1}{4}$.
22. Divide 3187 by $30\frac{1}{4}$.
23. Divide \$927 by \$18 $\frac{1}{4}$.

1. I spent \$5 and then had $\frac{3}{4}$ of my money left. How much had I at first?

2. How many pieces $\frac{3}{4}$ of a yard long can be cut from 5 yards?

3. From $\frac{1}{16}$ of a pound take $\frac{3}{16}$ of a pound.

4. Add: $\frac{5}{16}$ ft., $\frac{3}{8}$ ft., and $\frac{1}{4}$ ft.

5. What is 6 times $1\frac{3}{4}$ hr.?

6. Find $\frac{1}{2}$ of $2\frac{3}{4}$.

7. Multiply $2\frac{1}{2}$ by itself.

Find the cost of:—

8. $\frac{3}{4}$ lb. tea @ \$ 0.60.

9. 5 gal. oil @ $9\frac{1}{2}$ ¢.

$\frac{7}{8}$ lb. coffee @ 0.40.

6 lb. pork @ $8\frac{1}{2}$ ¢.

10. Change $6\frac{5}{8}$ to an improper fraction.

11. Change $\frac{7}{8}$ and $\frac{5}{12}$ to like units.

12. Change $\frac{1}{2}\frac{3}{4}$ to larger units.

13. Compare $\frac{1}{3}$ and $\frac{1}{4}$; $\frac{1}{3}$ and $\frac{1}{12}$; $\frac{1}{4}$ and $\frac{1}{20}$.

14. Is $\frac{1}{20}$ a very large or a very small fraction?

15. Compare $4\frac{1}{2}$ and 9.

16. If 9 barrels of flour are worth \$56, what are $4\frac{1}{2}$ barrels worth? If $4\frac{1}{2}$ lb. of lard are worth 60¢, what are 9 lb. worth?

17. What is the perimeter of a rectangle $2\frac{1}{2}$ inches long and $1\frac{1}{2}$ inches wide?

18. What part of a gallon is a pint? Of a bushel is a quart?

19. What part of a pound is 3 ounces? Of 2 lb. is 12 oz.?

20. What is the cost of $4\frac{3}{4}$ lb. of rice at 7¢?

21. What will 16 eggs cost at 30¢ a dozen?

HINT. 16 = — doz.

22. $\frac{3}{4}$ of my money taken from $\frac{1}{2}$ of it leaves \$12. How much money have I?

1. Add: $2\frac{1}{8}$, $14\frac{7}{8}$, and $36\frac{3}{10}$.
2. From $26\frac{4}{5}$ take $12\frac{9}{10}$.
3. One rod is $16\frac{1}{2}$ feet long. How many feet in 320 rods, or one mile?
4. How many rods in 6000 ft.?
5. How long is a square rod in feet? What is its perimeter?
6. How many square feet in a square rod? Draw a diagram of a square rod to some scale.
7. What will $5\frac{1}{8}$ lb. of steak cost at $15\frac{1}{3}\phi$ a pound?
8. At 42ϕ a yard, what will $17\frac{3}{4}$ yards cost?

Find the cost of the following articles:—

- | | |
|--|--|
| 9. $17\frac{1}{2}$ doz. pencils @ \$1.12 $\frac{1}{2}$. | 12. $2\frac{3}{4}$ yd. silk @ \$0.87 $\frac{1}{2}$. |
| 10. $\frac{1}{2}$ ream paper @ \$3.00. | 13. $4\frac{1}{2}$ doz. buttons @ \$0.19. |
| 5 boxes pens @ 0.37 $\frac{1}{2}$. | 16 ps. braid @ 0.11 $\frac{1}{4}$. |
| 11. $11\frac{5}{8}$ lb. turkey @ 24 ϕ . | 14. 23 lb. soap @ 2 $\frac{3}{4}$ ϕ . |
| $8\frac{1}{4}$ lb. chicken @ 17 ϕ . | 9 gal. vinegar @ 12 $\frac{1}{2}$ ϕ . |
15. At $7\frac{1}{2}\phi$ a pound, how much sugar can be bought for \$17 $\frac{1}{4}$?
 16. Compare $\frac{7}{15}$ and $\frac{3}{5}$.
 17. Compare $\frac{8}{15}$ and $\frac{3}{5}$.
 18. Bought $26\frac{3}{5}$ tons of coal at \$5 a ton, and sold $\frac{1}{2}$ of it at \$6 a ton, and the rest for \$100. What did I gain?
 19. After selling $\frac{7}{8}$ of my farm I had 160 acres left. How much had I at first?
 20. Take the sum of $4\frac{3}{5}$ and $7\frac{5}{10}$ from their product.
 21. I bought a horse for \$125, and sold him so as to gain $\frac{2}{5}$ of the cost. What did I get for him?
 22. I bought a farm for \$3200, and sold it at a loss of $\frac{1}{5}$. Find the selling price.
 23. I lost \$400 when I sold my farm. This was $\frac{1}{8}$ of what it cost me. Find the cost.

1. $3\frac{3}{4}$ lb. = how many ounces?
2. $\frac{2}{3}$ yd. at 75¢ per yard will cost what?
3. 3 lb. rice at $\frac{1}{2}$ ¢ per ounce?
4. $\frac{2}{3}$ of \$18 equals what?
5. Subtract $3\frac{3}{4}$ from $8\frac{1}{2}$.
6. $\frac{1}{2}$ of 50 is $\frac{1}{4}$ of what?
7. $100 - \frac{3}{4}$ of 80 = what?
8. 24 is $\frac{3}{4}$ of what number?
9. My money is $\frac{3}{4}$ silver and a \$20 gold piece. How much have I in silver?
10. When I have traveled $\frac{2}{3}$ of my journey I have 60 miles yet to go. How far have I traveled?
11. What shall I pay for 2 dozen lemons at 3 for 5¢?
12. What should I pay for 16 bananas at 10¢ per dozen?
13. Change $\frac{5}{8}$ and $\frac{7}{8}$ to 24ths; to 48ths.
14. Change $\frac{3}{8}$ and $\frac{7}{8}$ to a common unit.
15. Compare $\frac{5}{8}$ yd. with $\frac{4}{9}$ yd. What common unit do you use in making the comparison?
16. Take $\frac{5}{8}$ of 30 from $\frac{7}{12}$ of 84.
17. $2\frac{1}{2}$ lb. are what part of $12\frac{1}{2}$ lb.? Of 25 lb.?
18. What fraction multiplied by itself = $\frac{25}{4}$?
19. Cut $2\frac{1}{2}$ inches into 7 equal parts. What is the length of each part?
20. A farmer raised 30 bushels of wheat to the acre this year. He raised $\frac{1}{5}$ more than this last year. What was the yield per acre last year?
21. James jumps 6 ft. 10 in. John outjumps him by $\frac{3}{8}$ of a foot. How far does John jump?

1. By selling a horse for $\frac{1}{3}$ less than cost, I get \$56 for it. What was the cost?

2. I spend $\frac{1}{4}$, $\frac{1}{3}$, and $\frac{1}{5}$ of my money and have \$16 left. What had I at first?

3. By selling a house for $\frac{1}{5}$ more than it cost me I gain \$320. What did it cost me?

4. If $\frac{3}{4}$ of the value of a house is \$3540, what is its value?

5. If $\frac{3}{4}$ of a barrel of flour cost \$3 $\frac{1}{2}$, what will 5 barrels cost?

Change to like fractions:—

Change to like units and add:—

6. $\frac{2}{3}$, $\frac{5}{6}$, $\frac{7}{8}$, $1\frac{1}{2}$.

11. $\frac{2}{3}$, $1\frac{5}{12}$, $\frac{7}{8}$.

7. $\frac{2}{7}$, $\frac{3}{14}$, $\frac{2}{5}$, $\frac{1}{85}$.

12. $\frac{2}{5}$, $\frac{7}{15}$, $\frac{2}{3}$.

8. $\frac{1}{3}$, $\frac{2}{4}$, $\frac{5}{6}$, $\frac{1}{8}$.

13. $\frac{2}{7}$, $\frac{3}{8}$, $\frac{1}{4}$.

9. $\frac{2}{5}$, $1\frac{2}{5}$, $1\frac{1}{6}$, $\frac{4}{5}$.

14. $\frac{3}{11}$, $\frac{2}{3}$, $7\frac{7}{8}$.

10. $\frac{1}{3}$, $\frac{2}{5}$, $1\frac{1}{5}$, $\frac{5}{8}$.

15. $1\frac{1}{8}$, $\frac{2}{3}$, $5\frac{5}{12}$.

Multiply:—

Divide:—

16. $\frac{2}{7}$ of 711 by $1\frac{1}{4}$ of 100.

20. 1000 by $16\frac{3}{4}$.

17. $\frac{2}{4}$ of $9\frac{1}{4}$ by $\frac{2}{3}$ of $17\frac{1}{2}$.

21. $487\frac{2}{3}$ by $9\frac{3}{4}$.

18. $27\frac{4}{5}$ by $27\frac{4}{5}$.

22. $\frac{2}{3}$ of $7\frac{3}{4}$ by $\frac{4}{5}$ of $11\frac{4}{11}$.

19. $\frac{2}{3}$ of $\frac{7}{8}$ by $\frac{2}{3}$ of $\frac{3}{4}$.

23. $\frac{4}{5}$ of $\frac{7}{8}$ by $\frac{4}{5}$ of $\frac{3}{8}$.

24. I bought an 8-acre lot and divided it into $\frac{2}{3}$ -acre lots. How many lots?

25. I paid \$1200 for a 9-acre lot and divided it into lots of $\frac{3}{4}$ -acre each and sold for \$90 per lot. What did I gain?

26. Compare 144 and 108. What will 108 bars of soap weigh if 144 weigh 200 lb.?

1. What is the smallest coin in our money ?
2. What is the smallest silver coin ? The largest ?
3. What part of a dollar is 1 cent ? What part of a dollar is 25 cents ?
4. What part of a dollar is 1 dime ?
5. Read \$ 2.22 as dollars, dimes, and cents.
6. Compare each 2 in \$ 2.22 with the next 2 at the left. Which 2 stands for dimes or *tenths* of a dollar ? Which for cents or *hundredths* of a dollar ?

The *first* place at the right of the decimal point stands for *tenths*.
The *second* place at the right stands for *hundredths*.

7. Read as dimes and cents, then as tenths and hundredths of a dollar: \$ 0.45; \$ 0.87; \$ 0.54.
8. Read as dollars and hundredths of a dollar: \$ 3.45; \$ 5.08; \$ 3.97; \$ 1.09; \$ 5.40.

Using the dollar sign, write the following:—

- | | |
|--------------------------------|--------------------------------|
| 9. 50 hundredths of a dollar. | 12. 5 hundredths of a dollar. |
| 10. 25 hundredths of a dollar. | 13. 8 hundredths of a dollar. |
| 11. 43 hundredths of a dollar. | 14. 15 hundredths of a dollar. |

Since cents are *tenths* of *dimes*, and *dimes tenths* of dollars, they are called decimal parts of a dollar, and are said to be *written as decimals*.

We sometimes use decimals to show tenths and hundredths of other things. For example, $3\frac{7}{10}$ feet may be written 3.7 feet.

15. What does 3.2 yards mean ? 3.25 feet means what ?
16. Read the following: 3.48 lb.; 2.7 yards; 6.34 tons.
17. Write as decimals the following: $3\frac{2}{10}$; $6\frac{23}{100}$; $9\frac{14}{100}$; $6\frac{3}{100}$.

1. Write the largest number you can with the three figures, 2, 5, and 8.
2. The farther to the left of *ones'* place a figure is written, the — it represents.
3. The number 222 = — ones, — tens, and — hundreds.
4. The 2's in 222 each represent — of the value of the next one at the left, and — times the value of the next one at the right.
5. Any figure moved one place to the left is multiplied by —.
6. Any figure moved — place to the — is divided by 10.
7. 2 is multiplied by 10 by moving it one place to the left of *ones'* place. To do this we fill *ones'* place with a —.

When numbers are written at the right of the decimal point the same holds true. A figure written in any place has just $\frac{1}{10}$ the value it would have in the next place at the left. Hence the first figure at the right of the decimal point, or at the right of *ones'* place, is $\frac{1}{10}$ of 1; the next is $\frac{1}{10}$ of $\frac{1}{10}$ of 1, or $\frac{1}{100}$; the next, $\frac{1}{10}$ of $\frac{1}{100}$, or $\frac{1}{1000}$, etc.

8. If I change the decimal point in 22.2 feet so that it means 2.22 feet, what effect, in place, does it have upon each figure?

9. Compare 2.2 with 22.
11. Compare 0.6 and 0.06.
10. Compare 6 and 0.6.
12. Compare 1.2 and 0.12.
13. Moving the point one place to the right multiplies a number by —. Moving it — place to the — divides the number by 10.

Divide each by 10: —

14. 36.4; 8.4; 96.2; 900; 8.4; 3.65.
15. 1.4; 83.0; 2.4; 6; 17.5; 19.3.
16. Multiply by 10: 2.8; 34.2; 28; 1.64; 1.84.

1. The figures at the *left* of the decimal point may be written as *ones, tens, hundreds*, etc. Thus 555 is equal to $500 + 50 + 5$.

2. The figures at the right of the decimal point may be written as *10ths, 100ths*, etc. Thus 0.22 may be written $\frac{2}{10} + \frac{2}{100}$ or $\frac{22}{100}$. Write as a fraction 0.34; 0.28.

3. *Hundredths* are also written in another way. Instead of speaking of so many *hundredths*, we speak of *per cent*, which means the same thing. Thus $0.25 = \frac{25}{100} = 25\% = 25$ per cent.

4. Write the following in two other ways: 0.16; 0.28; 0.50; 0.75; 0.80; 0.40.

5. Write the following in two other ways: 25%; 40%; 50%; 75%; 80%; 10%.

6. Change to 100ths and write in two ways: $\frac{1}{2}$; $\frac{1}{4}$; $\frac{1}{8}$; $\frac{1}{10}$; $\frac{3}{8}$; $\frac{7}{8}$; $\frac{1}{5}$; $\frac{3}{4}$.

7. Find $\frac{25}{100}$ of \$400.

8. What is $\frac{15}{100}$ of 300 feet?

9. What is 20% of \$500?

10. What is 50% of \$100?

11. Compare 0.3 and 0.03. What effect on the value of a decimal if a zero is placed between the decimal point and the digit?

12. Compare 0.3 and 0.30. What effect on the value of a decimal has a zero written after the digit?

Explain the effect of the zeros in the following: —

13. 0.05.

16. 0.003.

19. 0.450.

22. 0.008.

14. 0.50.

17. 0.030.

20. 0.080.

23. 0.085.

15. 0.040.

18. 0.045.

21. 0.800.

24. 0.850.

25. What is 10% of 284? of 360? of 29.5?

26. What is 1% of 600? of 850? of 975?

27. 20% of 80? 30% of 60? 40% of 300?

1. Read 1.235. This is read one, *and* two hundred thirty-five thousandths, for the last figure, 5, is in thousandths' place.

Remember that the *first* place at the right of the decimal point is *tenths*; the *second* place is *hundredths*; the *third* place is *thousandths*.

Read the following:—

2. 3.053; 9.345; 10.05; 20.025; 0.053.

3. 0.008; 0.805; 1.081; 0.089; 100.01.

Express decimally:—

4. $3\frac{5}{10}$; $8\frac{5}{100}$; $9\frac{5}{1000}$; $1\frac{54}{1000}$; $\frac{48}{100}$.

5. $2\frac{8}{100}$; $3\frac{45}{100}$; $3\frac{45}{1000}$; $20\frac{2}{100}$; $25\frac{1}{1000}$.

Write:—

6. Two, and seventeen thousandths.

7. One hundred four, and thirty-eight hundredths.

8. Nine hundredths.

9. Six hundred nine thousandths.

10. Six hundred, and nine thousandths.

Read the following, add them, read the sum:—

11.	12.	13.	14.
3.05	0.8	0.903	0.703
4.109	1.45	9.07	8.973
6.028	0.806	0.86	9.09
<u>20.08</u>	<u>9.35</u>	<u>1.034</u>	<u>10.035</u>

Notice that the decimal points are all written in a column. This makes like units — tenths, hundredths, etc. — come under each other.

15. Write in columns and add: 3.08, 0.963, 8.4, 9.06, 10.034.

Read the numbers in the following columns:—

A	B	C	D	<u>E</u>
1. 0.38	0.09	0.004	2.08	27.642
2. 0.275	6.009	9.021	3.039	82.876
3. 0.386	0.301	0.036	7.346	93.923
4. 2.078	0.800	3.09	8.649	27.364
5. 0.97	3.09	2.006	84.6	2.804
6. 2.008	4.096	6.084	3.07	2.06

1-6. Write each row in columns and add.

7-11. Add each column without rewriting.

Find the difference between:—

- | | | |
|--------------|--------------|--------------|
| 12. A and B. | 15. A and E. | 18. B and E. |
| 13. A and C. | 16. B and C. | 19. C and D. |
| 14. A and D. | 17. B and D. | 20. C and E. |

Write as decimals and add:—

- | | | | |
|------------------------|--------------------|--------------------|-------------------|
| 21. $2\frac{5}{1000}$ | $3\frac{17}{1000}$ | $5\frac{18}{1000}$ | $7\frac{2}{10}$ |
| 22. $8\frac{8}{10000}$ | $4\frac{2}{100}$ | $7\frac{21}{1000}$ | $8\frac{18}{100}$ |

23. See whether you can tell the position of the right-hand figure of the decimal from the number of zeros in the denominator.

Write as decimals and find the difference:—

- | | |
|--|--|
| 24. $1\frac{8}{10000}$ and $2\frac{48}{1000}$. | 27. $1\frac{17}{1000}$ and $5\frac{1}{10}$. |
| 25. $3\frac{24}{100}$ and $1\frac{125}{10000}$. | 28. $1\frac{8}{100}$ and $1\frac{7}{10}$. |
| 26. $6\frac{28}{1000}$ and $7\frac{1}{10000}$. | 29. $3\frac{8}{1000}$ and $4\frac{2}{10}$. |

1. Compare 3 and 0.3. What effect has moving the decimal point from *before* 3; that is, moving it *one* place to the right?

2. 3.5 is $\frac{1}{10}$ of 35. Moving the decimal point *one* place to the right — it by —.

When there is no decimal *after* the point, the point need not be written; that is, 5 means the same as 5., for when no decimal point is written it is understood as being after the right-hand figure.

Multiply the following by 10 by moving the decimal point: —

3.	4.	5.	6.
2.46	90.3	0.008	0.84
38.4	0.874	0.906	84.1
0.286	0.063	0.075	0.009

7. Moving the decimal point *two* places to the right multiplies the number by what?

8. Compare 2.34 with 234.

Multiply the following by 100 by moving the decimal point: —

9.	10.	11.	12.
2.245	10.364	0.081	0.9
0.634	82.01	0.001	0.25
0.087	0.846	1.01	8.8
0.94	0.008	0.808	7.5

13. Moving the decimal point *one* place to the *left* divides a number by —; moving the point *two* places to the — divides it by 100.

14. Divide by 10 by moving the decimal point: 26.3; 3.8; 0.28; 302.4; 0.09.

15. Divide by 100: 34.2; 265; 0.34; 23.26; 80.6; 1.25.

16. When 100 things cost \$25 one costs what?

1. What is the relation of $\frac{3}{10}$ to $\frac{1}{10}$; that is, of 0.3 to 0.1? 0.1 of 3 = 0.3; then 0.3 of 3 = $\text{---} \times 0.3$, or --- .

2. We divide a number by 10; that is, find $\frac{1}{10}$ of it by moving the decimal point --- to the --- .

3. To find 0.4 of 1.5, we move the decimal point --- to the --- , and multiply the result by --- .

Give the following: —

4. 0.3×1.5 .

7. 0.6×4 .

10. 0.8×0.5 .

5. 0.8×0.2 .

8. 0.7×2.1 .

11. 0.6×30 .

6. 0.4×0.05 .

9. 0.5×0.6 .

12. 0.9×40 .

13. To divide by 100, that is, to find 0.01 of a number, we move the decimal point --- places to the --- .

14. $0.01 \times 24.5 = \text{---}$.

18. $0.01 \times 1.5 = \text{---}$.

15. $0.01 \times 200 = \text{---}$.

19. $0.02 \times 1.5 = \text{---}$.

16. $0.05 \times 200 = \text{---}$.

20. $0.04 \times 2.5 = \text{---}$.

17. $0.02 \times 500 = \text{---}$.

21. $0.25 \times 400 = \text{---}$.

We may often change *hundredths* or *per cent* to larger units, and then we have smaller numbers to deal with. For example, 0.25, or $25\% = \frac{25}{100}$, or $\frac{1}{4}$.

22. 0.25 of 28 = $\frac{1}{4}$ of 28 = --- ; 25% of 12 ft. = $\frac{1}{4}$ of 12 ft. = --- .

Find 0.25, or 25% , of the following: —

23. 16 ft.

26. 32 bu.

29. 24 gal.

32. \$96.

24. 40 qt.

27. 120 rd.

30. 36 doz.

33. 100 ft.

25. 60 pk.

28. 48 in.

31. \$84.

34. 80 pt.

35. $0.50 = 50\% = \frac{50}{100} = \text{---}$; $75\% = 0. \text{---} = \frac{75}{100} = \text{---}$.

36. 50% of \$10 = $\frac{1}{2}$ of \$10 = --- .

37. 50% of 90 ft. = $\frac{1}{2}$ of 90 ft. = --- .

1. $1 = \frac{100}{100} = \text{---} \%$; $\frac{1}{2} = \frac{50}{100} = \text{---} \%$; $\frac{1}{4} = \frac{25}{100} = \text{---}$;
 $\frac{3}{4} = \frac{75}{100} = \text{---} \%.$

2. A boy lost 25% of his marbles. What per cent of them did he have left? 1, or 100%, - 25% = ---.

3. Tom had 40 marbles and lost 25% of them. How many did he lose?

4. A boy has 12 blocks to walk to school. After he has gone 50% of the distance, how far has he to go?

5. If 0.4 of a farm is worth \$800, what is the whole farm worth?

6. I sold 5 hens; this was 25% of my flock. How many had I at first?

7. If 0.3 of a ton of hay costs \$6, what will 3 tons cost?

HINT. What is the relation of 3 to 0.3?

8. When coal is \$8 per ton, what will 0.8 ton cost?

Notice that all decimals except *hundredths* are expressed by the decimal point, and read 10ths, 1000ths, etc.

Hundredths may be written either by the point or the sign % but the latter is the more common, and it is then read *per cent*.

9. Find 25% of \$40.

12. \$3 is 25%, or $\frac{1}{4}$, of what?

10. Find 50% of 16 ft.

13. 6 ft. is 50%, or $\frac{1}{2}$, of what?

11. Find 75% of 8 yd.

14. 9 in. is 75%, or $\frac{3}{4}$, of what?

15. What part of 32 is 8? 8 is what per cent of 32?

16. What part of 40 is 20? 20 is what per cent of 40?

17. What part of 16 ft. is 12 ft.? 12 ft. is what per cent of 16 ft.?

18. Harry has 80 marbles, and Fred has 75% of this number. How many have both?

19. John caught 24 fish, and Henry caught 25% more. How many did Henry catch?

20. A farmer had 80 sheep and sold 75% of them. How many had he left?

1. Multiply 345 by 0.16.

$$\begin{array}{r}
 \text{WORK} \\
 345 \} = 3.45 \\
 \times 0.16 \} = \underline{16} \\
 = \underline{20.70} \\
 = \underline{34.5} \\
 = \underline{55.20}
 \end{array}$$

EXPLANATION. 0.16 of 345 means that we divide 345 into 100 equal parts and take 16 of these; that is, find 16 times $\frac{1}{100}$ of 345. $\frac{1}{100}$ of 345 is 3.45. In multiplying 5 *hundredths* by 6 we get 30 *hundredths* or 3 *tenths*, and no *hundredths*.

2. Multiply 26.4 by 0.08.

$$\begin{array}{r}
 \text{WORK} \\
 26.4 \} = 0.264 \\
 \times 0.08 \} = \underline{8} \\
 = \underline{2.112}
 \end{array}$$

Notice the 8 times 4 *thousandths* gives *thousandths* and is written in the *thousandths*' place. Be careful to put each number in its proper place in the product and always write the decimal point where it belongs.

Find the following products :—

- | | | |
|-------------------------|-------------------------|-------------------------|
| 3. 0.18×34.2 . | 7. 0.94×8.9 . | 11. 0.9×1.93 . |
| 4. 1.5×3.68 . | 8. 0.09×38.8 . | 12. 1.8×185 . |
| 5. 2.3×9.08 . | 9. 0.08×1.95 . | 13. 0.9×0.09 . |
| 6. 0.19×873 . | 10. 0.9×0.95 . | 14. 0.8×0.64 . |

15. Find the cost of 1.8 cords of wood at \$4.50 a cord.

16. If I pay \$8.50 for a ton of coal, what shall I pay for 23.6 tons?

17. I bought 340 acres of land and sold 38% of it. How many acres did I sell?

HINT. 1% of 340 means 0.01 of 340.

18. A man lost all but 45% of a crop of 1500 bushels of wheat. How many bushels did he save?

19. A man failing in business pays 25% of what he owes. What do I get if he owes me \$6750?

20. I bought a house for \$5600 and paid 80% cash and gave a note for the remainder. What was the face of the note?

21. A merchant sold \$3468 worth of goods in 1 week. If 15% of this was profit, what did he make?

1. Express as a common fraction and change to larger units:—

0.25; 0.35; 0.36; 0.125; 0.625; 0.725.

2. Write in a column and add:—

0.325, 7.64, 8.09, 0.009, 40.08, 17.06.

3. From 3.085 subtract 1.893.

4. I bought four loads of coal. The weights were as follows: 4.08 tons, 3.92 tons, 3.6 tons, 5.01 tons. How much coal did I buy?

5. From a farm of 120.4 acres were sold 73.92 acres. How much remained?

6. I bought 24.5 cords of wood. 0.4 of it was maple and the rest oak. How many cords of each?

7. A farmer raised in one field 349.5 bushels of beans, in another field 0.3 of this amount, and in a third 0.75 of this amount. How much did he raise in each field? What was his whole crop?

8. Charles caught 84 fish. 75% of them were perch. How many perch in the catch?

9. A farm cost \$3400, and the improvements cost 20% of this amount. What did the improved farm cost?

10. Find the cost of 13.8 cords of wood at \$4.30 a cord.

11. If 3.4 tons of coal cost \$28.50, what will 1.7 tons cost?

HINT. What is the ratio of 1.7 to 3.4?

12. If 0.38 of a farm is in wheat, 0.43 of it in grass, and the rest in orchard, what part of it is orchard?

13. After spending 68% of my money, how many per cent do I have left?

14. Change the following to a common fraction or a per cent:—

$\frac{1}{2}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{5}{16}$, $\frac{7}{8}$, 20%, 40%, 60%, 80%.

1. Find $\frac{1}{4}$ of 8.4; $\frac{1}{4}$ of \$12; $\frac{1}{4}$ of 0.08.

Remember that taking a part of a number does not change its unit; a part of dollars is dollars, of tenths is tenths, etc.

2. What is $\frac{1}{4}$ of \$6.90? $\frac{1}{4}$ of 16.8 ft.? $\frac{1}{4}$ of 8.5 miles?

3. Compare $4 \div 2$ with $400 \div 200$; $6 \div 3$ with $60 \div 30$.

4. Does multiplying both dividend and divisor by the same number affect the quotient?

5. Divide 8.4 by 0.4.

$8.4 \div 0.4 = 84 \div 4$; for both dividend and divisor were multiplied by 10. This was done by moving the decimal point — to the

Moving the decimal point the same number of places, and in the same direction in both dividend and divisor, does not change the quotient; for it is simply multiplying or dividing both by the same number.

6. Divide 3.48 by 1.2. **HINT.** Move both points one place to the right.

7. Divide 3.46 by 2.5.

WORK

$$\begin{array}{r}
 1.384 \\
 25 \overline{) 34.6} \\
 \underline{25} \\
 9.6 \\
 \underline{7.5} \\
 2.10 \\
 \underline{2.00} \\
 .100 \\
 \underline{.100} \\
 0
 \end{array}$$

EXPLANATION. First multiply both terms by 10. Why? $\frac{1}{10}$ of 34 = 3.4, and is written in *ones'* place. $\frac{1}{10}$ of 9.6 or 96 tenths is 9.6 tenths, and 9.6 is written in *tenths'* place. Since a zero on the right of a decimal does not change its value, we may bring down zeros and continue the division. After bringing down zeros, if there is a remainder after getting a quotient to any desired decimal place, the fact may be indicated by a plus (+) after the last figure; thus $10 \div 6 = 1.666+$.

- | | | |
|--------------------------|-------------------------|-------------------------|
| 8. $34.62 \div 32.4$. | 12. $9.63 \div 0.25$. | 16. $0.973 \div 2.61$. |
| 9. $7.68 \div 2.4$. | 13. $10.6 \div 0.72$. | 17. $0.8 \div 0.7$. |
| 10. $89.6 \div 0.42$. | 14. $12.8 \div 4.2$. | 18. $0.95 \div 0.12$. |
| 11. $0.782 \div 0.032$. | 15. $0.873 \div 1.46$. | 19. $0.84 \div 0.09$. |

1. 25 cents = what part of a dollar?
2. $12\frac{1}{2}$ cents = what part of 25¢? What part of \$1?
3. $6\frac{1}{4}$ cents = what part of $12\frac{1}{2}$ ¢? What part of \$1?
4. $37\frac{1}{2}$ cents = how many times $12\frac{1}{2}$ cents? What part of \$1?
5. 50 cents = what part of a dollar?
6. $62\frac{1}{2}$ cents = 50 cents + $12\frac{1}{2}$ cents = $\$ \frac{1}{2}$? + $\$ \frac{1}{4}$ = $\$ \frac{3}{4}$.
7. 75 cents = what part of \$1?
8. $87\frac{1}{2}$ cents = 75 cents + — = $\$ \frac{3}{4}$ + $\$ \frac{1}{8}$ = $\$ \frac{7}{8}$.

Learn the following parts of a dollar: —

$6\frac{1}{4}$ cents = $\frac{1}{16}$ of \$1.	$18\frac{3}{4}$ cents = $\frac{3}{16}$ of \$1.
$8\frac{1}{2}$ cents = $\frac{1}{8}$ of \$1.	$37\frac{1}{2}$ cents = $\frac{3}{8}$ of \$1.
$12\frac{1}{2}$ cents = $\frac{1}{4}$ of \$1.	$62\frac{1}{2}$ cents = $\frac{5}{8}$ of \$1.
$16\frac{3}{4}$ cents = $\frac{3}{8}$ of \$1.	$66\frac{3}{4}$ cents = $\frac{5}{4}$ of \$1.
25 cents = $\frac{1}{4}$ of \$1.	75 cents = $\frac{3}{4}$ of \$1.
$33\frac{1}{3}$ cents = $\frac{1}{3}$ of \$1.	$87\frac{1}{2}$ cents = $\frac{7}{8}$ of \$1.
50 cents = $\frac{1}{2}$ of \$1.	$31\frac{1}{4}$ cents = $\frac{5}{16}$ of \$1.

Find the cost of the following articles: —

- | | |
|---------------------------------|---------------------------------|
| 9. 16 lb. @ $12\frac{1}{2}$ ¢. | 16. 32 lb. @ $18\frac{3}{4}$ ¢. |
| 10. 36 yd. @ $8\frac{1}{8}$ ¢. | 17. 40 yd. @ $37\frac{1}{2}$ ¢. |
| 11. 42 lb. @ $16\frac{3}{4}$ ¢. | 18. 24 bu. @ $62\frac{1}{2}$ ¢. |
| 12. 40 bu. @ $12\frac{1}{2}$ ¢. | 19. 18 yd. @ $66\frac{3}{4}$ ¢. |
| 13. 15 ft. @ $33\frac{1}{3}$ ¢. | 20. 60 bbl. @ 75¢. |
| 14. 48 doz. @ $6\frac{1}{4}$ ¢. | 21. 16 rd. @ $31\frac{1}{4}$ ¢. |
| 15. 84 bu. @ 50¢. | 22. 32 bu. @ $87\frac{1}{2}$ ¢. |
23. At $6\frac{1}{4}$ ¢ a pound, how many pounds can be bought for \$1.00? \$0.50? \$1.50? \$2.00? \$2.50? \$3.00?
 24. At $12\frac{1}{2}$ ¢ a yard, how many yards can be bought for \$1.00? \$0.50? \$1.50? \$2.00? \$3.00? \$5.00?

1. At 25 cents each, how many baseballs can be bought for \$3? For \$5? For \$8?

2. At $12\frac{1}{2}$ cents a yard, how many yards of ribbon can be bought for \$3? For \$6? For \$15?

3. At $16\frac{2}{3}$ cents a pound, how many pounds of nuts can be bought for \$0.50? For \$1? For \$5? For \$12?

4. At $8\frac{1}{2}$ cents a pound, how many pounds of sugar can be bought for \$3? For \$5? For \$1.50? For \$7.50?

5. At $33\frac{1}{3}$ cents each, how many Roman candles can you buy for \$3? For \$5? For \$18? For \$25?

6. Divide \$5 by $12\frac{1}{2}$ cents.

SUGGESTION. Since \$1 contains $12\frac{1}{2}$ cents — times, \$5 will contain $12\frac{1}{2}$ cents — \times —, or —.

Divide the following at sight: —

- | | |
|------------------------------------|------------------------------------|
| 7. \$10 by $8\frac{1}{2}$ cents. | 13. \$40 by $33\frac{1}{3}$ cents. |
| 8. \$14 by 25 cents. | 14. \$50 by $16\frac{2}{3}$ cents. |
| 9. \$15 by 50 cents. | 15. \$100 by $8\frac{1}{2}$ cents. |
| 10. \$20 by $12\frac{1}{2}$ cents. | 16. \$20 by $16\frac{2}{3}$ cents. |
| 11. \$16 by 20 cents. | 17. \$60 by 25 cents. |
| 12. \$12 by $12\frac{1}{2}$ cents. | 18. \$90 by $8\frac{1}{2}$ cents. |

Find the cost of the following articles: —

- | | |
|--|---|
| 19. 240 sacks of salt @ $12\frac{1}{2}$ ¢. | 24. 1800 lb. lard @ $16\frac{2}{3}$ ¢. |
| 20. 360 lb. lard @ $8\frac{1}{2}$ ¢. | 25. 600 bu. coke @ $8\frac{1}{2}$ ¢ |
| 21. 800 doz. eggs @ 25¢. | 26. 840 bu. potatoes @ 50¢ |
| 22. 1200 bu. corn @ 50¢. | 27. 160 bu. apples @ 25¢. |
| 23. 720 qt. berries @ $12\frac{1}{2}$ ¢. | 28. 960 lb. cheese @ $12\frac{1}{2}$ ¢. |
| 29. At $12\frac{1}{2}$ cents a yard, how many yards will \$2½ buy? | |
| 30. At $16\frac{2}{3}$ cents a pound, how many pounds will \$3½ buy? | |

1. 10% means — hundredths, or one —.
2. I paid \$30 for a bicycle, and, after using it two months, I sold it at 10% less than it cost. What did I get for it? 10%, or $\frac{1}{10}$, of \$30 = —. \$30 - \$ — = \$ —.
3. We had 40 words in the spelling lesson, and I missed 10% of them. How many did I miss?
4. 25% = $\frac{1}{4}$ or $\frac{1}{100}$; 25% of \$8 means $\frac{1}{4}$ of \$8 or —.
5. A man had a flock of 400 sheep, but sold 25% of them. How many had he left?
6. A house cost \$6000. The lot cost 25% of the cost of the house. Find the cost of the lot.
7. I walked 25% of a certain distance and rode the rest of the way. If I walked 2 miles, how far did I ride?
8. Compare $12\frac{1}{2}\%$ and 25%.
9. Since 25% of anything is $\frac{1}{4}$ of it, what part of a thing is $12\frac{1}{2}\%$ of it?
10. I missed $12\frac{1}{2}\%$ of my exercises in a certain test. If there were 16 exercises, how many did I miss? What per cent did I have correct?
11. If you miss 5 words out of 40, what per cent do you miss?
12. A farmer harvested 80 bushels of beans, but $12\frac{1}{2}\%$ of them were damaged by rain. How many bushels of undamaged beans had he?
13. A man has a farm of 160 acres. 25% of it is in pasture. How many acres of pasture has he?
14. I buy a pony for \$36, and sell it at a gain of $16\frac{2}{3}\%$ ($\frac{1}{3}$). What is the selling price?
15. I miss $16\frac{2}{3}\%$ in a test of 18 problems. How many do I have correct?

1. $5 = \frac{1}{2}$ of 10; $25 = \text{---}$ of 100; $50 = \text{---}$ of 100; $12\frac{1}{2} = \text{---}$ of 100.

Learn the following:—

$$5 = \frac{1}{2}.$$

$$25 = \frac{1}{4}.$$

$$12\frac{1}{2} = \frac{1}{8}.$$

$$8\frac{1}{2} = \frac{1}{12}.$$

$$16\frac{2}{3} = \frac{1}{6}.$$

$$33\frac{1}{3} = \frac{1}{3}.$$

$$66\frac{2}{3} = \frac{2}{3}.$$

$$37\frac{1}{2} = \frac{3}{4}.$$

2. Multiply 320 by 25.

SUGGESTION. $25 \times 320 = \frac{1}{4} \times 320 = 100 \times 80 = 8000$.

Multiply the following by 25:—

3. 48.

6. 64.

9. 24.

12. 840.

4. 96.

7. 28.

10. 120.

13. 920.

5. 60.

8. 84.

11. 160.

14. 720.

Multiply by $12\frac{1}{2}$:—

15. 96.

18. 640.

21. 480.

24. 240.

16. 160.

19. 120.

22. 560.

25. 144.

17. 720.

20. 320.

23. 88.

26. 168.

Find the products:—

27. $8\frac{1}{2} \times 360$.

31. $33\frac{1}{3} \times 45$.

35. $37\frac{1}{2} \times 24$.

28. $16\frac{2}{3} \times 96$.

32. $33\frac{1}{3} \times 96$.

36. $66\frac{2}{3} \times 18$.

29. $12\frac{1}{2} \times 48$.

33. $8\frac{1}{2} \times 720$.

37. $37\frac{1}{2} \times 16$.

30. 50×400 .

34. $12\frac{1}{2} \times 840$.

38. $16\frac{2}{3} \times 360$.

Find the cost of the following articles:—

39. $12\frac{1}{2}$ lb. tea @ 24¢.

43. $33\frac{1}{3}$ yd. silk @ 90¢.

40. $8\frac{1}{4}$ bu. corn @ 72¢.

44. 50 doz. eggs @ 18¢.

41. $16\frac{2}{3}$ yd. cloth @ 36¢.

45. $12\frac{1}{2}$ qt. nuts @ 16¢.

42. 25 bbl. flour @ \$4.80.

46. $8\frac{1}{2}$ ft. pipe @ 48¢.

47. A farm of 120 acres has a wooded park equal to $8\frac{1}{3}\%$ of the whole farm. How many acres in the park?

In the following bill give:—

1. The date of purchase.
2. The name of the buyer.
3. The name of the seller or firm.
4. The number of items and the quantity, kind, price, and cost of each.
5. The amount of the bill.
6. The name of the clerk that received the money and receipted the bill.

Boston, May 21, 1903.

Miss Louise Bacon,

Bought of R. H. Stearns & Co.

14 yards English Serge @ \$1.25	\$17	50		
1½ yards Velvet @ 4.00	5	00		
2 yards Silesia @ .15		30		
Received Payment, R. H. Stearns & Co. By Johnson.			\$22	80

7. Suppose Miss Bacon had bought the following articles at the same store:—

12 yards China silk @ \$0.75.

1½ yards black silk @ \$2.

Make out and receipt her bill.

Make out bills of the following sales, using your teacher's name as buyer, and the name of some merchant near you:—

8. 23½ lb. coffee @ \$0.35.

9. 16½ yd. gingham @ \$0.42.

- 6½ lb. tea @ \$0.50.

- 4½ doz. buttons @ \$0.16.

Make out and receipt bills for the following: —

1. Mrs. A. L. Scott bought of Hunter & Co., Detroit, Mich., Oct. 7, 1903, 14 yd. cotton at 8¢ per yard; $8\frac{1}{2}$ yd. silk at \$1.25 per yard; $6\frac{1}{2}$ doz. buttons at 30¢; $6\frac{1}{4}$ yd. ribbon at 48¢ per yard; 12 yd. braid at $13\frac{1}{2}$ ¢. Clerk, yourself.

2. Mrs. M. E. Rice bought of A. L. Anderson & Sons, Chicago, Ill., Nov. 10, 1903, 9 lb. roast beef at 16 cents; $5\frac{3}{8}$ lb. lamb at 18 cents; $6\frac{5}{8}$ lb. steak at 18 cents; 2 turkeys weighing $12\frac{1}{2}$ and $15\frac{3}{4}$ lb. at 20 cents; $8\frac{1}{2}$ lb. sausage at 12 cents. Clerk, yourself.

3. A. L. Howe bought of Walter Shaw, Detroit, Mich., Dec. 10, 1903, $3\frac{1}{4}$ tons of hay at \$9.75; 62 bu. oats at \$.42 $\frac{1}{2}$; $8\frac{1}{2}$ cwt. of bran at \$2.25; 28 bu. shelled corn at 73 $\frac{1}{2}$ cents.

Make and receipt bills as below, using the name of some merchant near you, some one whom you know as buyer, and yourself as clerk: —

4. $6\frac{1}{2}$ lb. lard at 12 cents; $8\frac{1}{2}$ lb. bacon at 22 cents; 50 lb. sugar at $6\frac{1}{2}$ cents; 16 cans tomatoes at \$1.50 per doz.

5. 24 yd. calico at $8\frac{1}{2}$ cents; 18 yd. lining at $12\frac{1}{2}$ cents; $4\frac{3}{4}$ yd. flannel at 48 cents; 24 yd. braid at $3\frac{1}{2}$ cents.

6. $9\frac{3}{8}$ tons of coal at \$7.50; $12\frac{5}{16}$ cords of wood at \$4.00; 150 bushels of coke at $11\frac{1}{2}$ cents.

7. 64 qt. blackberries at $8\frac{1}{2}$ ¢; 32 qt. strawberries at $12\frac{1}{2}$ ¢; $2\frac{1}{2}$ bu. of cherries at \$2.25.

8. $8\frac{1}{4}$ lb. roast at 18 cents; $9\frac{1}{2}$ lb. sausage at 12 cents; 18 lb. chicken at $14\frac{1}{2}$ cents; 24 lb. lard at $16\frac{3}{4}$.

9. 5 reams paper at \$1.25; 2 M. envelopes at \$0.96; 6 gross pens at \$0.42; expressage 50¢.

10. 6 chairs at \$1.50; 2 rockers at \$2.75; 14 yd. carpet at \$0.90; laying and lining, \$2.16.

Written

BILLS

101

1. Which of the two men named in the bill below owes a debt, or is a debtor?
2. Which is the creditor to whom the debt is owed?

Lake Forest, Ill., Aug. 3, 1903.

Mr. John Hayes,

To James Anderson & Sons, Dr.

Terms: Cash.

5 lb. Raisins	\$ 0.15	\$0	75		
2 lb. Tea	.80	1	60		
3 doz. Oranges	.45	1	35		
4 lb. Prunes	.15		60		
				\$4	30

Received Payment,

James Anderson & Sons.

3. Dr. Henry Pratt has made 12 visits at Mrs. Mary Paul's, whose daughter has been ill. His charge is \$1.50 a visit. He has furnished \$2.75 worth of medicine. Make out his bill.

4. Mr. Dennis Murphy presents the following bill Sept. 1, 1903, for labor: spading flower beds \$1.25 for the job; $4\frac{1}{2}$ hr. raking the lawn at 20¢ per hour; $\frac{1}{4}$ day spading garden at \$1.50 a day. Use your own name as debtor, and make out a bill for him. Who should receipt the bill? Suppose you should pay his daughter Alice, how should she receipt it?

5. Ralph Barnes, a carpenter, does $3\frac{1}{2}$ days' work for Rev. Amos Blanchard at \$2.50, and furnishes 75 ft. of lumber at 3 cents, and 4 lb. nails at 6 cents. Make out Mr. Barnes's bill and receipt it.

1. What effect on the quotient has striking out or cancelling equal factors in both dividend and divisor?

2. $(6 \times 20) \div (6 \times 4) = 20 \div 4 = 5$. Why?

3. Divide $3 \times 4 \times 6$ by 6×2 .

When the product of a number of factors is to be divided by the product of another number of factors, the dividend is usually written above a line and the divisors below, and equal factors cancelled or crossed out.

4. Divide $3 \times 5 \times 20 \times 16$ by $5 \times 8 \times 3 \times 10$.

$$\text{WORK. } \frac{\overset{2}{\cancel{3}} \times \overset{2}{\cancel{5}} \times \cancel{20} \times \cancel{16}}{\cancel{5} \times \cancel{3} \times \cancel{10}} = 2 \times 2 = 4.$$

5. Divide the product of 8, 15, 4, 24, and 7 by 4, 8, 14, and 6.

6. Find the product of the fractions $\frac{1}{2}$, $\frac{2}{3}$, $\frac{4}{5}$, $\frac{3}{7}$, and $\frac{5}{8}$.

7. How many times is 72 contained in $3 \times 16 \times 84$?

8. Multiply together $\frac{3}{8}$, $\frac{4}{5}$, $\frac{5}{6}$, $\frac{7}{12}$, and $\frac{9}{10}$.

If dividend and divisor are not broken up into factors, sometimes the work may be simplified by removing common factors.

9. Divide 7500 by 150.

$$\text{WORK. } \begin{array}{r} 150 \\ 7500 \\ \hline 150 \\ 3 \end{array} = 50.$$

10. $7290 \div 630$.

$$\text{WORK. } \begin{array}{r} 7290 \div 630 \\ 81 \div 7 = 11\frac{4}{7} \end{array}$$

11. Divide 3645 by 225.

$$\text{WORK. } \begin{array}{r} 3645 \div 225 = \\ 729 \div 45 = \\ 81 \div 5 = 16\frac{1}{5} \end{array}$$

12. $3735 \div 135$.

13. $3924 \div 324$.

14. $4824 \div 864$.

15. $4356 \div 396$.

16. $\frac{8 \times 7 \times 6 \times 15}{10 \times 14 \times 3}$.

17. $\frac{17 \times 16 \times 14 \times 20}{34 \times 8 \times 7 \times 10}$.

1. What are the factors of 25? Of 36? Of 49?

A number composed of two *equal* factors is called a *square*, and one of the equal factors is called the *square root* of the number.

2. 81 is the square of what factor?
3. The *square root* of 81 is equal to what?
4. Give the square root of each of the following: —

25, 64, 49, 36, 81, 100, 16, 121, 144

The sign $\sqrt{\quad}$ means "find the square root of"; thus, $\sqrt{25} = 5$. 5^2 means that 5 is to be taken as a factor twice; thus, $5^2 = 5 \times 5$; $5^3 = 5 \times 5 \times 5$.

Any number that can be factored is a **composite** number.

5. Which of the following are composite?

48, 37, 84, 17, 96, 97, 125.

Learn the following: —

1. 2 is a factor of a number if it is a factor of the digit in *ones'* place, or if the number ends in a zero.

2. 3 is a factor of a number if it is a factor of the sum of the digits; thus, 3 is a factor of 135 for it is a factor of $1 + 3 + 5$.

3. 4 is a factor of a number if it is a factor of the number expressed by the last two digits, or if the number ends in two zeros; thus, 4 is a factor of 924 for it is a factor of 24.

4. 5 is a factor of a number if it ends in zero or 5.

5. 6 is a factor of an even number if it is divisible by 3.

6. 8 is a factor of a number if it is a factor of the number represented by the last three digits; thus, 8 is a factor of 92840 for it is a factor of 840.

7. 9 is a factor of a number if it is a factor of the sum of the digits.

A number that cannot be factored is called a **prime number**.

A factor that is a *prime number* is called a **prime factor**.

1. Find the prime factors of 4824.

WORK

$$\begin{array}{r} 2) 4824 \\ 2) 2412 \\ 2) 1206 \\ 3) 603 \\ 3) 201 \\ 67 \end{array}$$

EXPLANATION. As long as the number ended in an even number we could divide by 2. Then as long as the sum of the digits was divisible by 3 we knew 3 was a factor. Since 67 does not contain a factor below 9 it is prime for if 9 or a larger number is a factor, the quotient must be less than 9.

Find the prime factors of: —

- | | | | |
|---------|---------|-----------|-----------|
| 2. 267. | 6. 155. | 10. 5724. | 14. 648. |
| 3. 153. | 7. 315. | 11. 375. | 15. 972. |
| 4. 882. | 8. 495. | 12. 6039. | 16. 1026. |
| 5. 927. | 9. 524. | 13. 234. | 17. 927. |

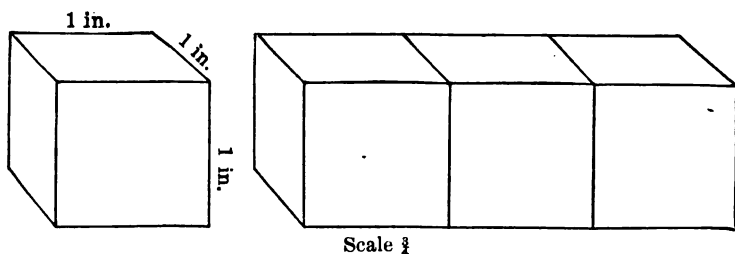
18. Find the factors of 853.

SUGGESTION. The divisors of 853 must be less than 30, for $30 \times 30 = 900$; therefore, if 30 is a divisor of 853, the quotient must be less than 30. By your tests will 853 contain 2? 3? 5? If a number will not contain 2, it will not contain 4, or 2 twos. Likewise it will not contain 6, so we need try only the prime numbers below 30. By trial is 7 a factor? Is 11? Is 13? Is 17? Is 19? Is 23? Why is it unnecessary to try any other number?

19. Since 853 has no factors except itself and 1, it is a — number.

Find the prime numbers and the prime factors of the composite numbers in the following: —

- | | | | |
|----------|----------|----------|-----------|
| 20. 105. | 24. 206. | 28. 207. | 32. 1243. |
| 21. 107. | 25. 307. | 29. 306. | 33. 487. |
| 22. 87. | 26. 299. | 30. 721. | 34. 284. |
| 23. 94. | 27. 349. | 31. 846. | 35. 506. |



1. We measure distances in inches, —, —, or —.
2. We measure surface in square inches, —, —, or —.
3. Solids occupy space and have weight, as a stone, a lump of coal, a piece of wood, a soap bubble, etc.

4. Solids have three dimensions: *length, breadth, and thickness.*

5. How many surfaces has the solid at the left?

6. Of what shape is each?

A solid bounded by *six square surfaces* is a **cube**.

7. How many corners has a cube? How many edges?

8. What is the length of each side of the cube shown above?

A cube whose edge is 1 inch is called a 1-inch cube, or a **cubic inch**.

9. How many faces has the solid at the right?

10. What is the shape of each?

A solid whose faces are rectangles is called a **rectangular prism**.

When two faces are squares as in the figure, it is called a **square prism**.

11. How many one-inch cubes will make a square prism as large as the one in the figure?

Since the square prism is equal to three one-inch cubes, we say **its volume is 3 cubic inches**.

1. How many one-inch cubes will it take to make a rectangular prism 3 inches long, 2 inches wide, and 1 inch thick?
2. What is the *volume* of a rectangular prism 3 inches by 2 inches by 1 inch?
3. How many one-inch cubes will it take to make a two-inch cube?
4. A two-inch cube contains how many *square prisms* 1 in. by 1 in. by 2 in.?
5. How many one-inch cubes will it take to make a three-inch cube?
6. How many square prisms 1 in. by 1 in. by 3 in. long in this cube? How many cubic inches in one of these square prisms? The volume, then, of a three-inch cube = $\text{?} \times 3$ cubic inches, or — cubic inches.

Written

7. What is the volume of a rectangular prism 8 inches long, 4 inches wide, and 3 inches thick?



SUGGESTION. To make 1 row 8 inches long requires — cubes; to make a layer 4 inches wide will require 4 rows or $4 \times \text{—}$ cubes, or — cubes; to make a solid 3 inches high will require 3 layers or $3 \times \text{—}$ cubes, or 96 cubes.

8. What is the volume of a prism 8 inches long, 5 inches wide, and 4 inches thick?
9. How many cubic inches in a 12-inch cube, or a *cubic foot*?

1728 cubic inches (cu. in.) = 1 cubic foot (cu. ft.).

10. What is the volume of a rectangular prism 5 feet long, 3 feet wide, and 2 feet thick?

1. How many cubic feet in a square prism 1 foot by 1 foot by 3 feet?

2. What is the volume of a rectangular prism 4 feet long, 3 feet wide, and 2 feet thick?

3. What is the volume of a 2-foot cube?

4. What is the volume of a 3-foot cube, or a *cubic yard*?

27 cubic feet (cu. ft.) = 1 cubic yard (cu. yd.).

5. A block of marble 9 feet long and 3 feet square at one end contains how many cubic feet? How many cubic yards?

6. How many cubic yards of earth were removed from a cellar 5 yd. long, 4 yd. wide, and 3 yd. deep?

Written

7. How many cubic yards of air in a room 24 feet long, 18 feet wide, and 12 feet high?

8. A granite block is 5 ft. long, 3 ft. wide, and 2 ft. thick. How many cubic feet does it contain?

9. How many cubic inches in a block 4 inches long, 3 inches wide, and 3 inches thick?

10. How many cubic inches in a brick 8 in. by 4 in. by 2 in.?

11. How many such bricks will fill a box 24 in. by 16 in. by 10 in.?

12. How many 3-inch cubes can you put into a cubical box 1 foot long?

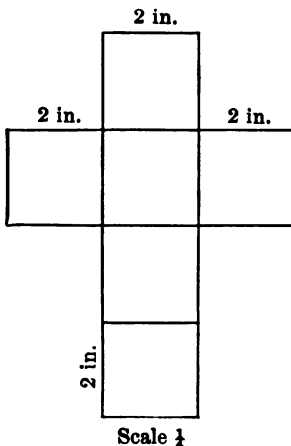
13. How many cubic yards of earth have been removed from a cellar 36 feet long, 24 feet-wide, and 9 feet deep?

14. I hire a man to dig a ditch 2 feet deep, 3 feet wide, and 300 yards long. What does it cost me at 18 cents per cubic yard?

1. Find surface of a rectangle 2 inches wide and 3 inches long.

2. Find the area of the entire surface of a 2-inch cube.

SUGGESTION. Cut a paper of the shape of the accompanying drawing and fold it into the form of a 2-inch cube.



3. What is the area of the entire surface of a 3-inch cube?

4. Find the number of square feet in the entire surface of a cubic yard.

5. Compare a 5-inch cube and 5 cubic inches.

6. Compare 4 cubic inches and a 4-inch cube.

7. A room is 10 feet wide and 12 feet long. How many feet of picture molding will it require?

8. What is the area of the floor? Of the ceiling?

9. If the room is 9 feet high, how many square feet in the four walls?

10. How many cubic feet of air does the room contain?

11. How many 3-inch squares can be cut from a 15-inch square?

12. How many more square inches in a 30-inch square than in a 2-foot square?

13. What is the ratio of their areas?

14. Find the cost of lathing and plastering in your place, and compute the cost of lathing and plastering the ceiling of your school-room.

15. What will it cost to paint the floor of the same room at 25¢ per square yard?

1. Find the volume of a rectangular solid 4 in. long, 2 in. wide, and 2 in. thick.

2. What is the shape of each end?

3. Give the shape and size of each of the other faces.

4. How many square inches in the entire surface?

5. Make a plan of proper size like the diagram and fold into a prism 2 in. by 2 in. by 4 in. Leave lapels as in the diagram for pasting.

6. Find the entire surface of a block of marble 5 ft. long, and 3 ft. square at each end.

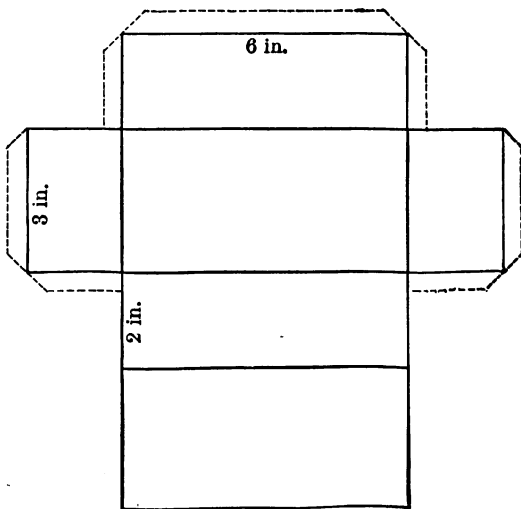
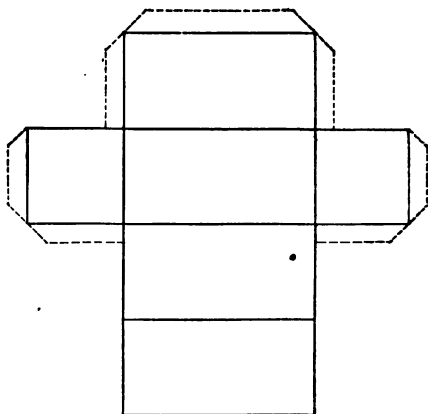
7. How many square inches of surface in a box 6 inches long, 3 inches wide, and 2 inches deep?

8. Study the diagram and make such a box from cardboard.

9. What is the volume of the box?

10. How many cubic inches in a box 10 in. long, 6 in. wide, and 4 in. deep?

11. Find area of its whole surface.



Scale $\frac{1}{4}$

1. The difference between two numbers is 309; the larger is 896. What is the smaller?
2. The dividend is 3978; the quotient is 306. What is the divisor?
3. If the product is 1728, and one factor is 144, what is the other?
4. The sum of two numbers is 9864, and one is 3987. What is the other?
5. How many pecks in 97 bushels and 3 pecks?
6. How many bushels in 583 pecks?
7. A flagstaff broke 37 feet from the ground; the part broken off was 67 feet long. How long was the flagstaff?
8. One man can do a piece of work in 16 days. How long will it take 4 men to do it?
9. One man can do a piece of work in 72 days. How many men will it take to do it in 8 days?
10. I sold my house for \$6500, thereby gaining \$285. What did the house cost me?
11. Bought a farm for \$5400, and sold it at a gain of 10% of the cost. What did I get for it?
12. A room is 36 feet long and 28 feet wide. How many square feet in the floor? Make a diagram.
13. If I have \$346.50 after spending \$587, how much had I at first?
14. How many square feet in 28 square yards?
15. If a man smokes 3 five-cent cigars daily, how much does he spend in this way in a year?

1. How many quarts in 368 pints?
2. How many quarts in 43 gal. and 3 qt.?
3. I borrow \$387, and pay back \$138.50. What do I still owe?
4. My bills for the month are: groceries \$28.93, meat \$12.75, milk \$5.64, gas \$3.90, light \$3.45, heat \$13.40. Find the total amount.
5. I bought a farm for \$8400, and sold it at a gain of 25%. What did I get for it?
6. The smaller of two numbers is 396, and the difference is 146. What is the larger?
7. If $\frac{1}{10}$ of my money is \$384, how much have I?
8. I bought a house for \$3400, and sold it at a loss of 10%. What did I get for it?
9. I sell a farm for \$3468, thereby losing \$524. What did it cost me?
10. The product of two numbers is 18,099. One of the factors is 9. What is the other?
11. The subtrahend is 9642, and the remainder 3462. What is the minuend?
12. Find $\frac{3}{8}$ of 608.
13. Add $\frac{3}{4}$ of 455 to $\frac{5}{8}$ of 2709.
14. Find the number of square feet in a flower bed 5 yards long and 4 yards wide.
15. I pay \$3.50 a month for electric light, and \$2.80 for gas. What do my gas and light cost me per year?
16. My board bill for Feb. 1904 at \$5 $\frac{1}{2}$ a week is — dollars.

1. At what shall I sell a bicycle that cost \$36 so as to make 25%?
2. A merchant pays \$18 for an overcoat and sells it at a gain of $33\frac{1}{3}\%$. What does he get for it?
3. What is 75% of 72 bushels?
4. I bought a bill of goods for \$146; I paid \$3.62 freight. For what must I sell the goods to gain \$22?
5. The sum of two numbers is 1000. One of them is 368. What is the other?
6. Two factors are 25 and 368. What is the product?
7. If the quotient is 38 and the divisor 27, find the dividend.
8. My house cost me \$4000. I have paid 75% of it. What do I still owe?
9. I bought a horse for \$150 and sold him at a gain of 20%. For what did I sell him?
10. How many quarts in $\frac{1}{2}$ of a bushel?
11. How many inches in $\frac{5}{8}$ of a yard? In $1\frac{1}{8}$ of a yard?
12. How many square inches in $\frac{1}{2}$ of a square foot? In $\frac{1}{4}$ of a square foot?
13. I bought 4 oz. of tea for 23¢. At this rate what will a pound cost?
14. When 8 oz. of butter costs 16¢, what will 5 lb. cost?
15. How many square inches in a square yard? Make a diagram.
16. I bought a house for \$5600 and sold it at a loss of 10%. What did I get for it?
17. What is $\frac{1}{24}$ of 962?

1. I paid \$3962 for a farm and sold it at a loss of 10%. For what did I sell it?

2. A merchant bought a case of dry goods for \$374.60. He paid \$3.68 expressage. For what must he sell them to gain \$98.50?

3. What is $\frac{1}{8}$ of \$39,924?

4. How many inches in 8 yards and 17 inches?

5. The sum of three numbers is 964. One is 278, another 493. What is the third?

6. What part of 24 is 8? Of 16 is 4? Of 32 is 8? Of 18 is 9?

7. In a certain school 488 pupils are enrolled. On a stormy day 25% were absent. How many were present?

8. If $\frac{1}{8}$ of a crop of wheat is 132 bushels, how many bushels in the whole crop?

9. If $\frac{1}{8}$ of my money is \$98, how much have I?

10. $\frac{1}{5}$ of the height of a certain flagpole is 17 feet. Find the height.

11. How many square inches in a surface 10 inches long and 8 inches wide? Make a drawing.

12. If your blackboard is 24 feet long and 4 feet wide, how many square feet does it contain?

13. How many square feet in a square yard? In 16 sq. yd.?

Find the cost of:—

14. 81 yd. @ \$1.25.

27 yd. @ \$0.83.

16 yd. @ \$0.75.

15. 36 lb. @ 18¢.

32 lb. @ $12\frac{1}{2}$ ¢.

96 lb. @ $8\frac{1}{8}$ ¢.

16. How many quarts in 2 bu. 3 pk.?

1. If I can walk a mile in 15 minutes, how long will it take me to walk 32 miles?
2. A farm that cost \$4500 was sold so as to gain 10%. What did it sell for?
3. How many square feet in an oblong 8 feet long and 14 feet wide?
4. If I can buy 16 lb. of sugar for \$1, how much can I buy for \$5?
5. How many square inches in an oblong 4 inches long and $3\frac{1}{2}$ inches wide? Make a drawing.
6. Which of these numbers may be divided by 2, which by 5, and which by 10? 20, 24, 30, 35, 40, 114, 115, 162, 170, 185, 200.
7. $\frac{1}{3}$ of 969 is how many more than $\frac{1}{3}$ of 1025?
8. Find the factors of 38, 26, 39, 42, 56, 63, 75.
9. If 3 men can do a piece of work in 12 days, how long will it take 9 men? How long will it take 12 men?
10. The remainder is 398, the subtrahend 768. What is the minuend?
11. The product is 38,940 and the multiplier 132. Find the multiplicand.
12. How many ounces is 13 lb. and 11 oz.?
13. A man willed \$47,120 in equal parts to 38 societies. What did each receive?
14. I paid \$120 for a horse and sold him so as to gain 50%. For what did I sell him?
15. How many feet in 342 inches?
16. How many inches in 17 feet and 10 inches?

Change to largest units:—

1. $\frac{26}{144}, \frac{288}{888}$.
2. $\frac{250}{800}, \frac{84}{756}$.
3. $\frac{26}{576}, \frac{216}{864}$.
4. $\frac{185}{555}, 0.45$.
5. $0.37\frac{1}{2}, 0.06\frac{1}{4}$.

Find the prime factors of:—

11. 600, 720.
12. 672, 444.
13. 810, 765.
14. 525, 3600.
15. 396, 1584.

Add:—

21. $16\frac{1}{8}, 10\frac{7}{8}, 4\frac{1}{8}$.
22. $25\frac{3}{4}, 8\frac{1}{4}, 21\frac{1}{4}$.
23. $9\frac{5}{16}, 4\frac{3}{8}, 7\frac{5}{16}$.
24. $\frac{18}{100}, 0.06, 2.5$.
25. $\frac{4}{1000}, 29.5, 3\%$.

Multiply:—

31. $6 \times 19\frac{3}{4}$.
32. $3\frac{3}{4} \times 84$.
33. $16\frac{2}{3} \times 40$.
34. $\frac{2}{3} \times \frac{4}{5} \times 1\frac{9}{10}$.
35. 0.04×12.5 .

Change to other forms:—

6. $32\frac{3}{4}, \frac{247}{16}$.
7. $416\frac{5}{8}, \frac{849}{18}$.
8. $29\frac{1}{5}, \frac{1000}{180}$.
9. $312\frac{3}{7}, \frac{8876}{120}$.
10. $401\frac{1}{2}, 0.096$.

Find the value of:—

16. $(14 \times 65 \times 72) \div 18 \times 70$.
17. $(18 \times 360) \div 9 \times 54 \times 10$.
18. $(84 \times 19 \times 6) \div 24 \times 57 \times 3$.
19. $(64 \times 32 \times 96) \div 1200$.
20. $374 \times 900 \div 30 \times 22$.

From:—

26. $18\frac{1}{4}$ take $11\frac{1}{8}$.
27. $25\frac{1}{4}$ take $3\frac{7}{8}$.
28. $80\frac{1}{4}$ take $17\frac{1}{2}\frac{3}{8}$.
29. $186\frac{1}{2}$ take $75\frac{3}{4}$.
30. 9.05 take $\frac{87}{1000}$.

Divide:—

36. 1000 by $6\frac{1}{4}$.
37. $48\frac{3}{4}$ by 5.
38. $\frac{9}{16}$ by $\frac{2}{3}$.
39. $4\frac{2}{3}$ by $5\frac{1}{2}$.
40. 0.84 by 1.5.

1. I bought a house for \$3650 and sold it at a gain of 10%. What did I get for it?
2. There are 540 square feet of floor in a certain room. If it is 20 ft. wide, how long is it?
3. My garden is 30 yards long and contains 720 square yards. How wide is it?
4. When the product is 897 and the multiplier 37, what is the multiplicand?
5. What will $37\frac{1}{2}$ lb. of coffee cost at 40¢ per pound?
6. A farmer exchanged 13 dozen eggs worth 25 cents a dozen for sugar at $6\frac{1}{4}$ cents a pound. How many pounds did he buy? (How many pounds of sugar did he get for 1 dozen eggs?)
7. How long is my lot if it contains 1200 square yards and is 72 feet wide?
8. A grocer bought vinegar at 20 cents a gallon, and sold it at 4 cents a pint. What did he make on 42 gallons?
9. $\frac{1}{10}$ of my yearly income is \$250. What do I receive per year? State $\frac{1}{10}$ in terms of per cent, and state the problem.
10. $\frac{2}{3}$ of a crop of beans is 136 bushels. What is the whole crop?
11. $\frac{1}{4}$ of the cost of my house is \$1535. What did it cost?
12. 10% of my land is 34 acres. How much have I?
13. A farmer has a young orchard. 34 of his trees, or 20% of them, die. How many are left?
14. After selling $\frac{3}{8}$ of his crop of beans a farmer has 570 bushels left. How many bushels did he sell?
15. Find the prime factors of 8640.

1. How much less than a thousand is the sum of $46\frac{3}{4}$, $362\frac{5}{8}$, $180\frac{1}{2}$?

Add:—

From:—

2. $17\frac{2}{3}$, $14\frac{1}{2}$, $13\frac{3}{4}$.

5. $73\frac{3}{4}$ take $16\frac{1}{4}$.

3. $16\frac{2}{3}$, $8\frac{7}{8}$, $9\frac{3}{8}$, $3\frac{1}{4}$.

6. $171\frac{1}{2}$ take $91\frac{3}{8}$.

4. $371\frac{1}{2}$, $614\frac{1}{8}$, $81\frac{3}{4}$.

7. $77\frac{1}{2}$ take $19\frac{1}{4}$.

8. From a bag holding 50 lb. of coffee I can fill a can holding $2\frac{1}{4}$ lb. how many times? How much will there be in the partly filled can?

9. How many chairs can you buy for \$20, if one chair costs $\$2\frac{3}{4}$?

10. If I use $\frac{7}{8}$ of a thousand-mile mileage book in a round trip between two cities, what is the distance between the cities?

11. I collected \$600 of money loaned the previous year, and found that I had lost $\frac{4}{9}$ of the debt besides the interest. How much did I lend?

12. The knoll in Prospect Park is reached by 36 granite steps. If the knoll is 24 ft. high, how high is each step?

13. If you retire when the curfew bell rings at 9 o'clock, and rise at 6, what part of every month do you spend in bed?

14. One laborer accomplished $\frac{1}{3}$ as much as his companion who can do the job in 26 days. How long will it take the other?

15. What shall I pay the slow workman, if I pay his companion \$1.60 a day?

16. My horse cost \$150, and my buggy 50% as much. What did both cost?

17. A suit was marked to sell at \$24. I buy it for 25% less than it is marked. What do I pay?

For Reference

1.

Liquid Measure, for measuring liquids—milk, oil, vinegar, etc.

4 gills (gi.) = 1 pint (pt.)

2 pints = 1 quart (qt.)

4 quarts = 1 gallon (gal.)

2.

Dry Measure, for measuring fruits, grains, etc.

2 pints = 1 quart

8 quarts = 1 peck (pk.)

4 pecks = 1 bushel (bu.)

3.

Avoirdupois Weight, used in weighing all common articles.

16 ounces (oz.) = 1 pound (lb.)

2000 pounds = 1 ton (T.)

4.

Time Measure

60 seconds (sec.) = 1 minute (min.)

60 minutes = 1 hour (hr.)

24 hours = 1 day (da.)

365 days = 1 year (yr.)

366 days = 1 leap year

5.

Measures of Length

12 inches (in.) = 1 foot (ft.)

3 feet = 1 yard (yd.)

$$\left. \begin{array}{l} 16\frac{1}{2} \text{ feet or} \\ 5\frac{1}{4} \text{ yards} \end{array} \right\} = 1 \text{ rod}$$
$$\begin{array}{l} 320 \text{ rods or} \\ 5280 \text{ feet} \end{array} \left. \vphantom{\begin{array}{l} 320 \\ 5280 \end{array}} \right\} = 1 \text{ mile}$$

6.

Square or Surface Measure

144 square inches = 1 square foot
(sq. in.) (sq. ft.)

9 square feet = 1 square yard
(sq. yd.)

$30\frac{1}{4}$ square yards = 1 square rod
(sq. rd.)

160 square rods = 1 acre (A.)

7.

Solid or Cubic Measure

$$\begin{array}{ccc} 1728 \text{ cubic inches} & = & 1 \text{ cubic foot} \\ (\text{cu. in.}) & & (\text{cu. ft.}) \end{array}$$

27 cubic feet = 1 cubic yard
(cu. yd.)

THE SOUTHWORTH-STONE ARITHMETIC

SECOND BOOK

PART II

A DECIMAL SYSTEM

1. In 5, 50, 500, and 5000, how does 5 change in value?
2. What value has the zero? What use has it?
3. Which of the following figures has the greatest value, 7, 3, 5, 9, 8? Which of the following, 30, 3, or 300?
4. The value of a figure then depends upon what two things?
5. Write the largest number you can, using just 0, 3, 5, and 8.
6. In Exercise 5, tell why you placed each figure where you did.
7. 10 ones = —; 10 tens = —; 10 hundreds = —; 10 thousands = —.
8. How many units of any order does it take to make one unit of the next higher order?
9. In the United States system of money, how many cents equal one dime? How many dimes in a dollar?

We call our system of writing numbers and our money system a **decimal system**. The word *decimal* is taken from the Latin *decem*, meaning "ten."

In a decimal system ten units of any order make one unit of the next higher order.

10. What is the unit in $\frac{1}{10}$ ft.? How many such units will it take to make 1 ft.? Explain why we may call $\frac{1}{10}$ a decimal fraction.

1. In 281,249,944 why are the figures grouped in threes?
2. Each group is sometimes called a **period**. Give the name of each period beginning with the lowest.
3. What is the value of the highest period? Of the next? Of the lowest?
4. Read the entire number.
5. Can you think of anything counted in millions?
6. Do we ever need larger numbers than millions?
7. The period next higher than millions is **billions**. Read the following: \$ 37,945,000,000.
8. Without using the word *million*, 3,456,000 may be read as 34——,56——.
9. In 5,347,000 what is the *order* of 7? Of 3? Of 4? Of 5?
10. How many hundred-thousands in this number? There are 534—— thousands in 5,347,000.
11. 3,500,000 may be read 35——, 350——, or 3500——.
12. The name of any group read depends upon the name of the order of the —— figure of the group.
13. Write the largest number you can with the figures 1, 5, 0, 7, 3, 9, 8, and 6. Read the number you have written.
14. Write the smallest number you can, using all the figures in Exercise 13. Read it.
15. Read this. In 1902 our exports to foreign countries were valued at \$ 1,360,696,355, and our imports at \$ 696,270,009. So we exported \$ 391,426,346 more than we imported.
16. Read: 308,260,097,308; 19,000,910,037.
17. Write: two hundred four billion, sixteen million, three thousand, two hundred seven.

1. Read 9,009,000. Of what use are the zeros ?
2. How many orders higher is 9 at the left than the other 9 ?
3. How many times as great in value is the left-hand 9 ?
4. How would the 9's be affected in value by removing the zeros in the first period ?
5. How is 4000 changed in value when we remove the last zero ? The last two ? All three ?
6. How can you give 387 a value a thousand times as great ?
7. Write the largest possible number using these nine figures only: 0, 1, 3, 3, 7, 7, 8, 8, 9.
8. Another zero would enable you to write a number how many times as large ?
9. How could you make 365,000 represent a number only one-thousandth part of this number ?
10. Each zero annexed to a number changes its value how ?
11. Each zero removed from the right of a number makes what change ?
12. Write 1 thousand 1 hundred 1.
13. Write 3 billion 96 million 5 thousand 48.
14. Write ten million, two thousand, sixty.
15. Without writing in columns and adding, write the sum of 18,000; 200,000; 520; 6.
16. Write the sum of 340; 2,000,000; 700,000; 48,000; 9.
17. Read without using the word *and*: 3005; 2806; 1,003,008.
18. Without writing, find $27,000,000 + 197,000 + 300 + 5$.
19. Find $16,000,000 + 908,000 + 16$.
20. From 97,000,000 take 230,000.

Give in one minute or less 48 sums of two digits each obtained by—

- (a) adding by columns of two each ;
 (b) adding in pairs along the line ;
 (c) adding the four digits in each square.

13	31	36	35	36	26	83	12	25	12	27	23
15	16	46	69	28	27	88	57	95	86	58	49
74	75	49	42	44	58	42	45	33	16	17	24
76	96	89	11	95	89	78	47	37	79	93	86

Practice until you can give each sum instantly:—

- | | | |
|------------|-------------|---------------|
| 1. 46, 34. | 10. 17, 33. | 19. 42, 66. |
| 2. 53, 27. | 11. 51, 29. | 20. 52, 68. |
| 3. 19, 71. | 12. 12, 58. | 21. 72, 88. |
| 4. 63, 27. | 13. 19, 31. | 22. 93, 27. |
| 5. 84, 16. | 14. 47, 24. | 23. 84, 46. |
| 6. 23, 47. | 15. 36, 26. | 24. 125, 275. |
| 7. 26, 54. | 16. 43, 29. | 25. 245, 355. |
| 8. 32, 28. | 17. 64, 28. | 26. 273, 127. |
| 9. 72, 18. | 18. 72, 36. | 27. 147, 153. |

Add by selecting when possible the numbers that will make 10 or 100:

- | | |
|--------------------|-----------------------|
| 28. 3, 5, 7, 6, 4. | 33. 1, 8, 9, 7, 2, 1. |
| 29. 2, 4, 8, 6, 5. | 34. 27, 73, 46. |
| 30. 1, 8, 7, 2, 3. | 35. 34, 66, 33. |
| 31. 8, 2, 7, 5, 3. | 36. 17, 54, 83, 46. |
| 32. 3, 9, 7, 6, 1. | 37. 43, 96, 57, 14. |

1. From 24 take 17.
2. Which is the subtrahend? Which the minuend?
3. The largest quantity is the —, the quantity to be taken from this is the —, and result is the —.
4. 36 inches — ? inches = 24 inches.
5. ? — 36 = 20; 48 — ? = 22.
6. When the minuend and remainder are known, how can you find the third term?
7. When the remainder and subtrahend are known, how can you find the minuend?

Supply the missing term in the following:—

Minuend:	28	54	84	46
Subtrahend:	<u>24</u>	<u>16</u>	<u>34</u>	<u>18</u>
Remainder:	36	19	56	24

Give in one minute or less the difference between —

- (a) each number and the one below it;
- (b) each number and the one at the right of it.

a	11	9	13	7	10	13	12	7	15	9	18	14
	2	5	7	3	9	8	6	5	8	4	8	5
b	9	9	10	16	11	6	14	11	15	11	8	16
	3	6	3	8	6	3	9	7	9	8	4	7
c	15	12	7	10	15	17	14	12	11	8	13	10
	7	3	4	5	6	9	8	7	5	5	4	7
d	12	10	17	12	11	13	16	13	18	12	8	12
	8	4	8	9	3	5	7	9	9	5	3	4

1. If you sleep 8 hr. and spend 6 at school, how many of the 24 remain?
2. Out of \$2 I spend 65¢, a half-dollar, and a dime. How much have I left?
3. Add the difference between 36 and 60 to the subtrahend.
4. Count backwards rapidly by 6's from 97. 5. By 8's from 97.
6. Count backwards by 13's from 100. 7. By 12's from 125.
8. $13 + ? = 120$. 9. $250 - ? = 120$. 10. $? + 34 = 96$.

What change shall I receive from \$1 if I spend —

- | | |
|------------------|------------------|
| 11. 25¢ and 45¢? | 15. 28¢ and 37¢? |
| 12. 16¢ and 34¢? | 16. 43¢ and 37¢? |
| 13. 27¢ and 18¢? | 17. 19¢ and 48¢? |
| 14. 16¢ and 49¢? | 18. 16¢ and 59¢? |

In the following table give rapidly the differences —

19. Between each number and 100.
20. Between each number and the one at the right of it.
21. Between each number and the one below it.

11	88	44	74	52	70	36	13	60	67	37	48	31	87
35	61	82	14	91	33	22	65	42	53	15	59	69	47
83	30	23	57	89	43	95	29	68	32	84	26	79	16
55	81	73	72	21	94	56	99	17	93	41	66	58	51
92	19	63	45	96	18	86	46	76	49	71	62	27	85
64	77	24	28	34	39	78	38	80	25	97	54	98	40

22. From 1000 take 346. (We may begin at the *left* and take each number except 6 from 9, and at once give the remainder 654.)

23. In the same way give at sight $10,000 - 6,734$; $100,000 - 46,028$; $10,000 - 7,308$.

Add by lines and by columns:—

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>
1.	2347	1745	4632	1234
2.	1589	9408	9687	7654
3.	3462	7865	7596	9234
4.	6221	9860	4572	7503
5.	5056	6676	4635	3576
6.	<u>1587</u>	<u>2973</u>	<u>9274</u>	<u>2678</u>

7. Add the four sums of columns *a*, *b*, *c*, and *d* and compare the result with the amount of the six sums obtained by adding the lines. (If the work is correct, these two sums will be alike. Why?)

	<i>a</i>	<i>b</i>		<i>c</i>	<i>d</i>
8.	2469	— 1897.	12.	9468	— 9298.
9.	8424	— 6468.	13.	9124	— 8963.
10.	9462	— 9378.	14.	7291	— 6987.
11.	6983	— 6899.	15.	8139	— 7993.

16. Find the difference between the sums of columns *a* and *b*.

17. Add the differences obtained in 8, 9, 10, and 11. Does this equal the difference in 16? Why should it?

18. From the sum of column *c* subtract the sum of column *d*.

19. Find the sum of the four differences in columns *c* and *d*.

20. From 8788 take 1998.

22. From 9016 take 8432.

21. From 8092 take 7924.

23. From 19,036 take 9,867.

Write down the differences, beginning at the left:—

24.	25.	26.	27.
63,000	340,000	190,000	380,000
<u>45,378</u>	<u>193,764</u>	<u>173,465</u>	<u>349,693</u>

28. Write the difference without copying: 1,000,000 — 738,296.

1. If you have forgotten the product of 4×7 , how can you find it by addition?

2. How can you find quickly $9 + 9 + 9 + 9 + 9$?

3. Can you use the same process to find $3 + 8 + 11 + 9$?

4. In finding 5 9's which number is to be multiplied?

5. Which is the multiplier?

6. What does the multiplier show?

7. $? \times \$8 = \24 ; $4 \times ? = 12$ ft.

8. Of the following numbers, which apply to things that can be seen, handled, or measured? —

5 books; 3 ft.; \$8; 15; 4; 6 qt.; 8 bu.; 25; 10 strokes.

9. Which of the above numbers are used without reference to things of any kind?

Numbers that are applied to things of any kind are **concrete numbers**.

Numbers used without reference to things of any kind are **abstract numbers**.

10. $5 \times \$10 = \50 . Name the kinds of numbers used in this example.

11. Which of the factors (makers) is abstract, the multiplier or multiplicand?

12. What are the factors (makers) of \$24? Of 18 ft.?

13. Get $4 \times \$12$ by addition. Which is the multiplier? Can the multiplier ever be a concrete number?

14. Give two factors of each of the following, stating which factor is multiplicand: —

48 yd.; 32 rd.; \$40; 49 min.; 63 da.; 26 bu.

1. Tell the units in the following :—

4 ft. ; 6 bu. ; \$ 8 ; 9 ft. ; \$ 16 ; 3 bu. ; 6 qt.

2. Select those that have *like units*, that is, units of the same *kind* and *size*.

Like numbers are those that have like units.

3. Give the products of $13 \times \$3$; 8×5 in. ; 12×9 men.
4. Of the three terms, multiplier, multiplicand, and product, which must be like numbers ? Which one *must always* be abstract ?
5. Compare 3×4 with 4×3 .
6. Compare 4×5 ft. with 5×4 ft.

Principles in Multiplication

- I. *Only one factor can be concrete. Both may be abstract.*
- II. *The product and concrete factor will be like numbers.*
- III. *The order in which factors are used will not affect the quotient.*

7. 9 and 12 are factors of what ? 13 and 5 ? 19 and 3 ?
8. Give two factors making : 63 ; 72 in. ; 48 ; 91 ft. ; 56 da.
9. Separate into two equal factors, or find the square root of : 25 ; 81 ; 49 ; 144 ; 121 ; 196 ; 169.
10. Give the two factors of 132 sec. ; 125 in. ; 144¢ ; 108 hr.
11. Annex a zero to 25 and give the value of 2 and 5 before and after the change.
12. Read these numbers multiplied by 10, 100, and 1000 :—
37 ; 64 ; 125 ; 278 ; 3257 ; 2178 ; 9840.
13. Mention the multiplicands : 8×5 qt. ; 6×15 ; 3×4 ft.

1. In the number 24, what does the 4 stand for? What does the 2 stand for?

2. If you annex a zero to 24, what does the 4 become? What does the 2 become?

3. Compare 30 and 3, 50 and 5, 100 and 10, 12 and 120.

4. Make a rule for multiplying by 10.

5. Compare 300 and 3, 500 and 5, 2500 and 25.

6. How would you multiply by 100? By 1000?

Every zero annexed to an integer multiplies it by 10.

7. Read the following numbers multiplied by 10, by 100 and by 1000:—

25; 38; 835; 3963; 5178; 7250; 34526.

8. Compare 30×25 with $3 \times 10 \times 25$; 20×42 with $2 \times 10 \times 42$.

9. Make a rule for multiplying by any number of 10's, 100's, etc.

10. Find the product of 20×16 ; 30×15 ; 40×12 ; 50×25 .

11. Multiply \$125 by 136.

12. Which is the multiplier?

13. What three partial multipliers are used?

14. Read each partial product.

15. Could we have multiplied by 100 first?

WORK

$$\begin{array}{r}
 \$125 \\
 136 \\
 \hline
 6 \times \$125 = \$750 \\
 30 \times \$125 = \$3750 \\
 100 \times \$125 = \$12500 \\
 \hline
 136 \times \$125 = \$27000
 \end{array}$$

16. With which partial multiplier do you usually begin?

17. In ordinary work, how much of this may be omitted?

18. Where is the lowest figure of a partial product to be written?

1. $\$20 \div 5$ means that $\$20$ is to be separated into — parts, or that we are to find $\frac{1}{5}$ of $\$20$. The quotient $\$4$ shows the size of each part.

2. $\$20 \div \5 means that $\$20$ is to be separated into groups of — each, and the quotient 4 shows the number of groups.

Division, then, has two uses: —

I. *To find the size of one of the equal parts of a dividend.*

II. *To find how many parts of a given size the dividend contains.*

3. Illustrate the two uses in the following: $24 \text{ lb.} \div 4 \text{ lb.} = 6$; $48 \text{ oz.} \div 12 = 4 \text{ oz.}$; $\$72 \div \$9 = 8$; $60 \text{ ft.} \div 3 \text{ ft.} = 20$.

Solve the following and tell what the divisor and quotient show in each case: —

4. 36ϕ was divided equally among 9 boys. How much did each boy receive?

5. At $\$3$ each, how many chairs can I buy for $\$18$?

6. I bought 5 tons of coal for $\$45$. What did I pay for a ton?

7. I pay $\$12$ for help at $\$2$ a day. How many days' help do I get?

8. $90 \text{ inches} \div 9 \text{ inches} = \text{— times}$; $90 \text{ inches} \div 9 = \text{— inches}$.

9. When the dividend is concrete, are the other terms, the divisor and quotient, like or unlike?

I. *A divisor like the dividend is one of its equal parts, and the quotient shows the number of these parts.*

II. *When the dividend is concrete and the divisor abstract, the divisor shows into how many equal parts the dividend is divided. The quotient is one of these parts, and hence is like the dividend.*

1. One factor of 60 yd. is 4 yd. Find the other.
2. $42 \text{ ft.} \div 7 = \text{---}$; $90 \text{ in.} \div 6 \text{ in.} = \text{---}$.
3. Divide by 2; 3; 4; 5; 6. Give integral quotient and remainder:—
54; 69; 76; 87; 98; 89; 78; 67; 45.
4. Use the divisors 50; 60; 70; 80; 90. Give the integral quotient and remainder:—
450; 520; 636; 724; 837; 964; 523; 649.
5. \$62,500 is separated into packages of \$125 each. How many packages?
6. What number repeated 125 times is equal to 750 min.?
7. \$208 is distributed among 8 persons. How many dollars will each receive?

Written

8. Divide 837 by 31.

$$\begin{array}{r}
 27 \\
 31 \overline{)837} \\
 \underline{62} \\
 217 \\
 \underline{217} \\
 0
 \end{array}$$

EXPLANATION. We say 83 *tens* $\div 31 = 2$ tens, and write the 2 *tens* above, in *tens'* place. $31 \times 2 \text{ tens} = 62 \text{ tens}$. 62 tens is written under 83 tens and subtracted. The remainder, 21 tens and 7 ones = 217 ones. $217 \text{ ones} \div 31 = 7 \text{ ones}$. 7 is written in *ones'* place. $31 \times 7 = 217$, which when subtracted leaves no remainder. The quotient is 27. That is, $\frac{1}{31}$ of 837 = 27.

9. Find $\frac{1}{8}$ of \$84,231.
10. Find $\frac{1}{52}$ of \$8291.
11. $\frac{1}{28}$ of 8008.
12. $\frac{1}{78}$ of 162,944.
13. There are 144 square inches in 1 square foot. How many square feet in 178,364 square inches? How many square inches remaining?
14. There are 27 cubic feet in 1 cubic yard. How many cubic yards in 34,696 cubic feet?

- | | | |
|-----------------------|-----------------------|------------------------|
| 1. 536×243 . | 5. 645×879 . | 8. 726×894 . |
| 2. 687×593 . | 6. 456×783 . | 9. 948×798 . |
| 3. 794×936 . | 7. 869×963 . | 10. 647×896 . |
| 4. 897×346 . | | |

Find the cost of—

- | | | |
|---|------------------------------------|--------------------------|
| 11. 367 T. of hay at \$9.75. | 15. 967 doz. eggs at \$0.18½. | |
| 12. 649 cords of wood at \$6.85. | 16. 892 gal. of oil at \$0.08½. | |
| 13. 859 bu. of potatoes at \$0.78. | 17. 6498 lb. of cotton at \$0.09½. | |
| 14. 649 bbl. of sugar at \$15.97. | 18. 986 lb. of butter at \$0.28½. | |
| 19. $28,607 \div 23$. | 26. $20,708 \div 83$. | 33. $268,047 \div 192$. |
| 20. $82,054 \div 64$. | 27. $31,609 \div 39$. | 34. $960,784 \div 286$. |
| 21. $86,704 \div 78$. | 28. $19,074 \div 29$. | 35. $709,643 \div 189$. |
| 22. $20,687 \div 38$. | 29. $98,076 \div 37$. | 36. $194,627 \div 297$. |
| 23. $67,209 \div 52$. | 30. $78,062 \div 19$. | 37. $286,074 \div 395$. |
| 24. $27,068 \div 92$. | 31. $29,086 \div 28$. | 38. $370,693 \div 495$. |
| 25. $82,067 \div 79$. | 32. $67,094 \div 49$. | 39. $268,476 \div 798$. |
| 40. What will 1 bbl. of flour cost when 126 bbl. cost \$714.42? | | |
| 41. What will 1 yd. of carpet cost when 235 yd. cost \$509.95? | | |
| 42. If 925 bu. of wheat cost \$971.25, find the cost of 1 bu. | | |
| 43. 728 lb. of cotton sold for \$65.52. What was that per pound? | | |
| 44. Sold 217 bbl. of pork for \$4806.55. What did I get per bbl.? | | |
| 45. When 2965 bu. sell for \$859.85, what was that a bushel? | | |
| 46. 295 A. of land sold for \$9410.50. Find the price per acre. | | |
| 47. $\$12,904 \div \192 . | 51. $\$1,193,874 \div 3745$. | |
| 48. $\$22,946 \div \4.18 . | 52. $\$219,368 \div \798 . | |
| 49. $\$502,468 \div 1928$. | 53. $\$967,840 \div 1982$. | |
| 50. $\$524,928 \div 598$. | 54. $\$768,475 \div \269 . | |

Suggestive exercises from the table on the opposite page are given below. They may be extended as desired.

Addition

1. Add from *a* through *j* in col. 5.
2. In col. 6.
3. In col. 7.
4. Add from *c* through *m* in col. 5.
5. In col. 6.
6. In col. 7.
7. Add from *f* through *q* in col. 5.
8. In col. 6.
9. In col. 7.
10. Add from *m* through *z* in col. 5.
11. In col. 6.
12. In col. 7.
13. Add from *a* through *p* in col. 5.
14. In col. 6.
15. In col. 7.
16. Add from *a* through *z* in col. 5.
17. In col. 6.
18. In col. 7.

Find the sum of the numbers opposite the letters in the following words in column 7:—

- | | |
|------------------|------------------|
| 19. variety. | 24. harmonious. |
| 20. accuracy. | 25. extravagant. |
| 21. facility. | 26. philosophy. |
| 22. determined. | 27. voluntary. |
| 23. facetiously. | 28. fumigate. |

NOTE. Lists of words on the board may be used at pleasure in this way.

- 29-54. Find the sum of the numbers in each line.

Subtraction

Find the difference between numbers in the same line.

1. *a-z*. In columns 5 and 6.
2. *a-z*. In columns 6 and 7.

Find the difference between each number and the one below it.

3. *a-y*. In column 5.

4. *a-y*. In column 6.
5. *a-y*. In column 7.

Multiplication

Find the product of the numbers in each line.

1. *a-z*. In columns 1, 2, and 3.
2. *a-z*. In columns 4 and 5.
3. *a-z*. In columns 4 and 6.
4. *a-z*. In columns 5 and 6.
5. *a-z*. In columns 6 and 7.

Division

1. *a-z*. Divide each number in column 7 by the number in the same line in column 1.
2. *a-z*. In the same way divide column 5 by column 3.
3. *a-z*. Divide col. 6 by col. 4.
4. *a-z*. Divide col. 7 by col. 5.

Written **TABLE FOR DRILL IN FUNDAMENTAL PROCESSES**

	1.	2.	3.	4.	5.	6.	7.
<i>a</i>	2	13	63	197	1345	46,768	104,876
<i>b</i>	9	28	80	928	2769	14,693	340,276
<i>c</i>	7	49	91	873	3876	24,768	950,073
<i>d</i>	5	15	64	417	4245	71,293	268,479
<i>e</i>	10	30	81	652	8347	60,037	728,735
<i>f</i>	3	54	93	765	9038	73,407	629,876
<i>g</i>	8	20	68	739	6705	19,386	724,894
<i>h</i>	11	32	84	984	9477	47,682	548,075
<i>i</i>	4	56	95	859	6841	86,573	829,386
<i>j</i>	12	21	70	487	7238	94,775	445,876
<i>k</i>	6	36	87	529	5467	89,238	377,872
<i>l</i>	15	57	96	843	3094	64,839	763,804
<i>m</i>	5	24	72	468	6298	29,466	689,903
<i>n</i>	9	42	89	757	4787	48,748	670,498
<i>o</i>	8	59	69	836	6432	98,396	988,875
<i>p</i>	4	25	75	793	8978	47,874	687,568
<i>q</i>	7	45	90	581	6479	56,832	994,693
<i>r</i>	11	48	98	629	9463	91,478	849,376
<i>s</i>	6	27	76	924	8779	16,923	649,478
<i>t</i>	13	60	99	786	3678	94,873	384,923
<i>u</i>	16	75	77	937	6482	73,689	569,247
<i>v</i>	19	46	93	724	5962	69,798	347,964
<i>w</i>	17	74	87	692	7389	54,991	976,394
<i>x</i>	7	69	79	496	8917	98,346	298,973
<i>y</i>	9	57	96	739	8998	79,819	917,966
<i>z</i>	14	93	67	496	9843	54,433	723,468

TO THE TEACHER. Accuracy and speed in fundamental operations come c
through much practice. To secure this the drill table is provided. Numl
should be copied only when absolutely necessary. The pupil should learn
add, subtract, multiply, and divide with numbers in any relative position, writ
results only. In addition the sum of each column of digits should be retain
and the total found therefrom. In multiplication only the partial products n
be written.

1. How many inches in 12 ft. and 9 in. ?
2. How many pints in 5 gal. 3 qt. ? In 15 gal. $3\frac{1}{2}$ qt. ?
3. 5 bu. and 3 pk. are equal to how many pecks ?
4. How many feet in 276 inches ? In 348 ? In 492 ?
5. How many inches in 6 yd. and 2 ft. ? In 7 yd. and 28 in. ?
6. How many gallons in 1872 pt. ? In 1776 pt. ?
7. How many yards in 4500 inches ? In 4428 inches ?
8. How many ounces in 24 lb. and 12 oz. ?
9. How many pounds in 5 T. and 1675 lb. ?
10. How many seconds in a day ? In 3 da. and 15 hr. ?
11. How many hours in the month of July ?
12. How many 3-oz. packages can be put up from 9 lb. and 12 oz. of pepper ?
13. How many pint bottles can be filled from a tank holding 300 gal. ?
14. If one of your steps measures 28 in., how many will you take in going half a mile ?
15. What is the distance around a rectangular park 600 yd. long and 25 rd. wide ?
16. Purchased apples at \$1.20 a bushel and sold them at 45¢ a peck. What did I gain on a bushel ?
17. I get 3 qt. of milk a day. How many gallons do I use during the month of August ? What is my bill at 18¢ a gallon ?
18. Henry lives $1\frac{1}{2}$ miles from the schoolhouse. In going to school he rode 240 rd., how far did he walk ?
19. In 3946 inches, how many yards ?
20. In 25 lb. and 12 oz., how many ounces ?
21. Find the value at 12¢ per 14-oz. package of 1 T. 1031 lb. of borax.

1. $\frac{3}{4}$ means 3 of the — equal parts of a thing. $\frac{3}{4}$ of \$12 means — of the — equal parts of \$12, or \$—.
2. How many quarts in $\frac{3}{4}$ pk.? Inches in $\frac{3}{4}$ yd.?
3. $\frac{5}{8}$ means what? $\frac{5}{8}$ means what? Which is larger, $\frac{5}{8}$ or $\frac{5}{9}$? Why?
4. How many 6ths in 1? Is $\frac{3}{8}$ ft. more or less than 1 ft.? How much?
5. How many dollars in \$ $\frac{13}{8}$? In \$ $\frac{29}{8}$? In \$ $\frac{15}{8}$?
6. Compare $\frac{3}{4}$ ft. with $\frac{5}{8}$ ft. Draw each.
7. What does $\frac{5}{12}$ of anything mean? Draw $\frac{5}{12}$ ft.
8. Compare $\frac{2}{12}$ with $\frac{1}{6}$; $\frac{3}{12}$ with $\frac{1}{4}$; $\frac{4}{12}$ with $\frac{1}{3}$; $\frac{5}{12}$ with $\frac{1}{2}$.
9. How many hours in $\frac{5}{12}$ of a day? In $\frac{7}{12}$ of a day?
10. How many things in $\frac{11}{12}$ of a dozen? How many inches in $\frac{7}{12}$ of a foot?
11. How many fifths in 1? In 3? In $2\frac{3}{5}$? In $7\frac{2}{5}$?
12. How many 6ths does it take to make 1? In $\frac{12}{6}$, how many 1's? In $\frac{18}{6}$? In $\frac{17}{6}$? In $\frac{11}{6}$?
13. Show by a drawing that $\frac{1}{2} = \frac{2}{4}$; that $\frac{1}{2} = \frac{3}{6}$; that $\frac{3}{4} = \frac{6}{8}$.
14. $\frac{1}{3}$ equals how many 6ths? How many 9ths? How many 12ths?
15. $\frac{5}{6}$ equal how many 12ths? How many 18ths?
16. $\frac{10}{6} = \frac{5}{3}$; $\frac{24}{6} = \frac{4}{1}$; $\frac{15}{6} = \frac{5}{2}$; $\frac{34}{6} = \frac{17}{3}$.
17. Show by a drawing that $\frac{1}{8}$ of $\frac{1}{4} = \frac{1}{32}$; that $\frac{1}{2}$ of $\frac{1}{5} = \frac{1}{10}$; that $\frac{1}{4}$ of $\frac{1}{5} = \frac{1}{20}$.
18. Show by a drawing that $1 - \frac{3}{8} = \frac{5}{8}$; that $\frac{1}{4} + \frac{3}{8} = \frac{5}{8}$.

1. Name the unit in each of the following: —
 $\frac{3}{4}$ in.; $\frac{5}{8}$ gal.; $\frac{7}{8}$; $\frac{10}{4}$; 3 ft.; $\frac{3}{4}$ wk.; $\frac{3}{16}$ lb.
2. Does a large denominator show a large or a small unit?
3. Name the two terms of a fraction. Does changing to smaller terms mean changing to smaller or larger units?
4. When we change a fraction to smaller units, how are the terms changed, that is, are they made smaller or larger?
5. How many 8ths of anything in the whole of it?
6. $\frac{43}{8}$ = how many 1's and how many 8ths remaining?
7. What two units in the number $\$7\frac{3}{4}$?
8. A number consisting of integral and fractional units is a — number.
9. A fraction whose numerator is equal to or larger than its denominator is called an — fraction.
10. Change to improper fractions: $2\frac{5}{8}$; $3\frac{1}{9}$; $4\frac{7}{10}$; $6\frac{4}{15}$.
11. Change to mixed numbers: $\frac{11}{7}$; $\frac{40}{8}$; $\frac{28}{5}$; $\frac{50}{11}$; $\frac{19}{7}$.
12. Change to mixed numbers or improper fractions: —
 $100\frac{4}{7}$; $2\frac{3}{5}$; $66\frac{2}{3}$; $45\frac{9}{10}$; $\frac{51}{4}$; $\frac{80}{35}$; $\frac{2517}{100}$.
13. By a diagram show that $\frac{3}{8} = \frac{3}{12}$.
14. To get 12ths from 3ds, what change do you make in the size of the fractional units?
15. If each of 2 thirds was divided into 4 equal parts, the 2 thirds = —.
16. What does a large denominator show? Give a very small fractional unit.
17. What does a large numerator show?

CHANGES IN THE NUMBER OF FRACTIONAL UNITS TO CORRESPOND WITH THEIR SIZE

1. 3 weeks; 21 days. Compare the size of the units; the number of units; the value of the two expressions.
 2. Why is the larger number of no greater value than the smaller?
 3. In the same way compare 5 yd. and 15 ft.
 4. Give other examples of equal values expressed in units of different size.
 5. As in exercises 2 and 3 compare $\frac{1}{4}$ and $\frac{3}{12}$, and tell why the value of $\frac{3}{12}$ is no greater than $\frac{1}{4}$.
 6. How does an *increase* in the size of the denominator affect the size of the unit?
 7. How does an *increase* in the numerator affect the value of a fraction?
 8. How does a *decrease* in the denominator affect the size of the unit?
 9. How does a *decrease* in the numerator affect the value of a fraction?
 10. If each term of $\frac{3}{18}$ be made $\frac{1}{2}$ as large, how is the value affected? Why is this?
 11. Make each term of $\frac{2}{3}$ three times as large. Explain how the size of the units and their number are affected.
- Both terms of a fraction may be multiplied or divided by the same number without changing the value of the fraction.*
12. By the use of this principle, change to 40ths:—

$$\frac{8}{9}; \frac{7}{10}; \frac{5}{4}; \frac{3}{5}; \frac{10}{80}; \frac{24}{160}; \frac{40}{200}; \frac{3}{20}; \frac{160}{240}; \frac{48}{240}; \frac{88}{480}.$$

1. Using the principle on the preceding page, change $\frac{210}{525}$ to smallest terms, that is, to the *largest possible fractional unit*.

WORK

$$\frac{5 \overline{)210}}{5 \overline{)525}} = \frac{3 \overline{)42}}{3 \overline{)105}} = \frac{7 \overline{)14}}{7 \overline{)35}} = \frac{2}{5}$$

EXPLANATION. Since 5 is a factor of both terms, we divide both terms by it, thus obtaining the fraction $\frac{42}{105}$. The terms of this fraction each contain a factor 3, which, stricken

out, gives $\frac{14}{35}$; this, by taking out a factor 7 from each term, equals $\frac{2}{5}$.

2. Instead of dividing successively by 5, 3, and 7, we might have divided by 105, the product of the three factors, or the greatest divisor common to both terms, or their **Greatest Common Divisor** (g. c. d.). Solve the example in this way.

3. To find the greatest common divisor of 210 and 525.

WORK

$$210 = 2 \times 5 \times 3 \times 7$$

$$525 = 5 \times 5 \times 3 \times 7$$

$$3 \times 5 \times 7 = 105 \text{ g. c. d.}$$

EXPLANATION. Since 5, 3, and 7 are the only prime factors common to both numbers, their product must be the largest factor common to both.

Find the greatest common divisor of the terms, and change to largest fractional units:—

4. $\frac{153}{881}$.

8. $\frac{210}{504}$.

12. $\frac{625}{1225}$.

16. $\frac{227}{881}$.

5. $\frac{336}{720}$.

9. $\frac{126}{246}$.

13. $\frac{104}{156}$.

17. $\frac{162}{288}$.

6. $\frac{85}{120}$.

10. $\frac{288}{880}$.

14. $\frac{120}{168}$.

18. $\frac{126}{210}$.

7. $\frac{105}{281}$.

11. $\frac{175}{250}$.

15. $\frac{240}{512}$.

19. $\frac{63}{147}$.

20. Change $\frac{3}{8}$, $\frac{7}{9}$, $\frac{5}{16}$, and $\frac{9}{24}$ to 144ths.

21. Change $\frac{7}{18}$, $\frac{11}{24}$, $\frac{28}{144}$, and $\frac{156}{216}$ to 72ds.

22. Change $\frac{36}{48}$ and $\frac{60}{96}$ to the largest common unit.

23. Change $\frac{2310}{3710}$ to smallest terms.

24. Change $\frac{1250}{2520}$ to largest fractional units.

25. Change $\frac{4860}{8840}$ to smallest terms.

1. Name some dividends that will exactly contain 12, that is, name some multiples of 12.

2. Name the prime factors of 12. Does the product of all the prime factors of a number always equal the number?

3. Will a number whose factors are 2, 3, and 5 be a multiple of 3×5 or 15, that is, will a number whose factors are 2, 3, and 5 contain 15 without a remainder?

4. What are the prime factors of 30? Of 42?

5. Since the factors of 30 are 2, 3, 5 and the factors of 42 are 2, 3, 7, what factors must a dividend have in order to contain 30 and 42 exactly?

6. What are the prime factors of 12? Of 15?

7. What factors in 12 not in 15? What one in 15 not in 12?

8. Does 12×5 contain all the factors of 15?

9. Will 12×5 or 60 contain both 12 and 15, that is, is 60 a multiple of both?

10. What factor in 21 is not found in 15? Is 7×15 or 105 a multiple of 21 and 15? Why?

Written

11. Change $\frac{4}{15}$ and $\frac{5}{21}$ to like units.

SUGGESTION. $15 = 3 \times 5$. 3 is found in 21, but 5 is not, hence 5×21 or 105 is the least multiple, or dividend, common to both; so we are to change to 105ths. By principle on page 137, $\frac{4}{15} = \frac{28}{105}$, $\frac{5}{21} = \frac{25}{105}$.

Change to like units and add:—

12. $\frac{3}{8}$ and $\frac{1}{18}$. (18 contains a 2 and one 3 that 33 does not contain; hence the least common dividend is $33 \times 2 \times 3$ or 198.)

13. $\frac{7}{24}$ and $\frac{1}{11}$.

15. $\frac{5}{12}$ and $\frac{2}{12}$.

17. $\frac{7}{40}$ and $\frac{1}{10}$.

14. $\frac{2}{3}$ and $\frac{7}{12}$.

16. $\frac{1}{12}$ and $\frac{2}{30}$.

18. $\frac{3}{10}$ and $\frac{1}{10}$.

1. Change to 12ths: $\frac{1}{2}$; $\frac{1}{3}$; $\frac{2}{3}$; $\frac{1}{4}$; $\frac{3}{4}$; $\frac{1}{5}$; $\frac{4}{5}$.
2. Change to like units: $\frac{3}{2}$; $\frac{2}{3}$; $\frac{3}{4}$; $\frac{4}{5}$; $\frac{1}{6}$.
3. Change to like units: $\frac{2}{3}$; $\frac{1}{4}$; $\frac{2}{5}$; $\frac{3}{5}$; $\frac{4}{15}$.

Add the following:—

- | | | |
|---|------------------------------------|-------------------------------------|
| 4. $\frac{1}{5} + \frac{2}{4} + \frac{1}{10}$. | 7. $5\frac{1}{2} + 3\frac{1}{4}$. | 10. $5\frac{1}{2} + 6\frac{3}{4}$. |
| 5. $\frac{3}{10} + \frac{1}{5} + \frac{5}{6}$. | 8. $6\frac{2}{3} + 5\frac{2}{3}$. | 11. $6\frac{2}{3} + 7\frac{2}{3}$. |
| 6. $\frac{5}{12} + \frac{3}{4} + \frac{1}{6}$. | 9. $7\frac{1}{2} + 6\frac{3}{8}$. | 12. $7\frac{1}{2} + 6\frac{1}{6}$. |
13. Add by $2\frac{1}{2}$ from 0 to 25; from 1 to 26; from 2 to 27.
 14. Add by $3\frac{1}{2}$ from 0 to 50; from 1 to 51; from 2 to 52.

Find the values of:—

- | | | | |
|------------------------------------|-------------------------------------|------------------------------------|-------------------------------------|
| 15. $\frac{1}{2} - \frac{1}{3}$. | 18. $\frac{5}{9} - \frac{5}{12}$. | 21. $\frac{4}{5} - \frac{7}{15}$. | 24. $1\frac{1}{2} - \frac{5}{8}$. |
| 16. $\frac{3}{5} - \frac{2}{10}$. | 19. $\frac{5}{9} - \frac{2}{3}$. | 22. $\frac{7}{8} - 1\frac{1}{4}$. | 25. $1\frac{3}{5} - \frac{3}{10}$. |
| 17. $\frac{3}{5} - \frac{2}{8}$. | 20. $\frac{7}{12} - \frac{3}{16}$. | 23. $\frac{5}{6} - \frac{5}{7}$. | 26. $2\frac{1}{4} - \frac{3}{8}$. |
27. Compare $\frac{4}{5}$ and $\frac{1}{3}$; $\frac{4}{5}$ and $\frac{2}{3}$; $\frac{1}{2}$ and $\frac{4}{11}$; $\frac{1}{7}$ and $\frac{4}{17}$.
 28. Compare $\frac{1}{5}$ and $\frac{1}{10}$; $\frac{1}{6}$ and $\frac{1}{18}$; $\frac{1}{7}$ and $\frac{1}{21}$; $\frac{1}{4}$ and $\frac{1}{12}$.

Multiplying the numerator of a fraction increases the number of equal parts, and hence multiplies the fraction.

Dividing the denominator increases the size of the equal parts, and hence multiplies the fraction.

Tell which method you use in the following:—

- | | | | |
|-------------------------------|-------------------------------|-------------------------------|--------------------------------|
| 29. $4 \times \frac{3}{5}$. | 32. $7 \times \frac{6}{14}$. | 35. $6 \times \frac{2}{7}$. | 38. $15 \times \frac{7}{10}$. |
| 30. $5 \times \frac{2}{10}$. | 33. $6 \times \frac{7}{12}$. | 36. $8 \times \frac{2}{16}$. | 39. $17 \times \frac{3}{12}$. |
| 31. $6 \times \frac{2}{3}$. | 34. $5 \times \frac{3}{8}$. | 37. $9 \times \frac{1}{16}$. | 40. $13 \times \frac{1}{16}$. |

1. How do you find $\frac{3}{4}$ of a circle? Of an oblong? Of a number?
2. Compare $\frac{3}{4}$ and $\frac{3}{16}$. When you divide 4ths into four equal parts, what fractional unit do you get?
3. When you divide 5ths into 4 equal parts, what do you call the parts?
4. To find $\frac{3}{4}$ of $\frac{5}{7}$.

WORK

$$\frac{3}{4} \text{ of } \frac{5}{7} = \frac{3 \times 5}{4 \times 7} = \frac{15}{28}$$

EXPLANATION. Since to find $\frac{3}{4}$ of a number is to divide it into 4 equal parts and then take 3 of them, we divide $\frac{5}{7}$ into 4 equal parts and have $\frac{5}{28}$; then taking 3 of these we have $\frac{15}{28}$.

- | | | |
|--|---|---|
| 5. $\frac{3}{8}$ of $\frac{5}{7} = \text{---}$. | 8. $\frac{2}{5}$ of $\frac{7}{8} = \text{---}$. | 11. $\frac{2}{5}$ of $\frac{4}{7} = \text{---}$. |
| 6. $\frac{4}{7}$ of $\frac{9}{11} = \text{---}$ | 9. $\frac{2}{5}$ of $\frac{5}{7} = \text{---}$. | 12. $\frac{8}{9}$ of $\frac{10}{11} = \text{---}$. |
| 7. $\frac{3}{8}$ of $\frac{7}{10} = \text{---}$ | 10. $\frac{4}{7}$ of $\frac{8}{9} = \text{---}$. | 13. $\frac{4}{7}$ of $\frac{11}{12} = \text{---}$. |

Finding a part of a number is usually called "multiplying by a fraction," and the sign of multiplication (\times) is used for "of," but must still be read "of"; thus $\frac{3}{8} \times \frac{5}{7}$ is read $\frac{3}{8}$ of $\frac{5}{7}$.

Since the numerator of the product is the product of the numerators, and the denominator of the product the product of the denominators, factors common to both numerator and denominator may be struck out before multiplying. This is called cancellation. Thus —

$$\frac{3}{8} \times \frac{16}{21} = \frac{\overset{2}{\cancel{3}} \times \overset{2}{\cancel{16}}}{\underset{7}{\cancel{8}} \times \underset{7}{\cancel{21}}} = \frac{2}{7} \text{ or simply } \frac{\overset{2}{\cancel{3}} \times \overset{2}{\cancel{16}}}{\underset{7}{\cancel{8}} \times \underset{7}{\cancel{21}}} = \frac{2}{7}$$

Written

In this way find: —

- | | | | |
|--|--|--|--|
| 14. $\frac{4}{7} \times \frac{21}{16}$. | 18. $\frac{4}{11} \times \frac{33}{16}$. | 22. $\frac{18}{16} \times \frac{70}{80}$. | 26. $\frac{4}{15} \times \frac{80}{90}$. |
| 15. $\frac{5}{9} \times \frac{36}{10}$. | 19. $\frac{2}{3} \times \frac{15}{12}$. | 23. $\frac{14}{15} \times \frac{45}{60}$. | 27. $\frac{3}{17} \times \frac{85}{90}$. |
| 16. $\frac{10}{12} \times \frac{36}{80}$. | 20. $\frac{7}{13} \times \frac{39}{80}$. | 24. $\frac{17}{17} \times \frac{55}{80}$. | 28. $\frac{2}{3} \times \frac{36}{80}$. |
| 17. $\frac{2}{3} \times \frac{15}{12}$. | 21. $\frac{12}{15} \times \frac{36}{80}$. | 25. $\frac{33}{12} \times \frac{80}{90}$. | 29. $\frac{18}{16} \times \frac{80}{90}$. |

1. How many times is $\frac{2}{3}$ contained in $\frac{1}{3}$? In $1\frac{1}{3}$? In $2\frac{1}{3}$?
2. At $\$ \frac{3}{4}$ a bushel, how many bushels of potatoes can be bought for $\$ 5\frac{1}{4}$?
3. At $\$ \frac{5}{8}$ per yard, how many yards can be bought for $\$ 5\frac{5}{8}$?
4. At $\$ \frac{2}{3}$ per bushel, how many bushels of apples can be bought for $\$ 2\frac{5}{8}$?
5. $5\frac{5}{8}$ yd. of cloth are divided into pieces each containing $1\frac{7}{8}$ yd. How many pieces?
6. If you can earn $\$ \frac{2}{3}$ a day, how long will it take to earn $\$ 6$?
7. At $\$ \frac{1}{3}$ per pound, how much coffee can be bought for $\$ 2$?
8. If a horse eats $\frac{3}{4}$ bu. of oats a day, how long will 6 bu. last?

Find the value of the following: —

- | | | |
|---------------------------------------|---------------------------------------|--------------------------------------|
| 9. $\frac{3}{8} \div \frac{3}{4}$. | 13. $1\frac{3}{4} \div \frac{3}{4}$. | 17. $\frac{3}{8} \div \frac{1}{8}$. |
| 10. $\frac{3}{8} \div \frac{1}{2}$. | 14. $1\frac{3}{8} \div \frac{3}{4}$. | 18. $\frac{3}{8} \div \frac{5}{8}$. |
| 11. $\frac{9}{10} \div \frac{3}{8}$. | 15. $1\frac{5}{8} \div \frac{1}{2}$. | 19. $\frac{3}{8} \div \frac{1}{8}$. |
| 12. $\frac{2}{7} \div 1\frac{3}{4}$. | 16. $\frac{9}{10} \div \frac{1}{8}$. | 20. $\frac{1}{6} \div \frac{1}{8}$. |
21. If $\frac{1}{2}$ a farm is worth $\$ 600$, what is the whole farm worth?
 22. I sold a cow for $\$ 48$; this was $\frac{2}{3}$ of what I paid for her. Find the cost.
 23. I paid $\$ 45$ for a bicycle and sold it for $\frac{2}{3}$ of the cost. What did I lose?
 24. I paid $\$ 120$ for a horse and sold him at a loss of $\$ 20$. What part of the cost did I get?
 25. A can holds $1\frac{1}{2}$ gallons. How many times will 18 gallons fill it?

1. How many 8ths in 1, that is, $1 \div \frac{1}{8} =$ what?

2. $1 \div \frac{3}{7} = \frac{7}{3} \div \frac{3}{3} =$ —.

3. Compare the quotients of $1 \div \frac{3}{8}$ with $2 \div \frac{3}{8}$; with $3 \div \frac{3}{8}$; with $\frac{3}{2} \div \frac{3}{8}$.

4. Since $1 \div \frac{3}{7} = \frac{7}{3}$, $\frac{3}{4} \div \frac{3}{7} = ?$ of $\frac{7}{3}$ or —.

5. $\frac{5}{9} \div \frac{4}{11} = \frac{5}{9}$ of $(1 \div \frac{4}{11})$ or $\frac{5}{9}$ of $\frac{11}{4} =$ —.

NOTE. One can always find the quotient of 1 divided by any fraction without the use of pencil, and simply write down the quotient, so the above example in practice should be written $\frac{5}{9} \div \frac{4}{11} = \frac{5}{9} \times \frac{11}{4} = \frac{55}{36} = 1\frac{19}{36}$.

6. $\frac{3}{8} \div \frac{5}{82} =$ —.

NOTE. In this example both fractions are more easily changed to like units. In this way the result can be seen to be $1\frac{1}{2}$ without using a pencil.

Select the shorter method in solving the following:—

7. $\frac{1}{12} \div \frac{3}{4}$.

11. $\frac{7}{8} \div \frac{5}{12}$.

15. $\frac{7}{12} \div \frac{4}{5}$.

8. $\frac{4}{5} \div \frac{4}{7}$.

12. $\frac{27}{8} \div \frac{5}{16}$.

16. $\frac{25}{7} \div \frac{5}{18}$.

9. $\frac{3}{16} \div \frac{5}{24}$.

13. $\frac{7}{8} \div \frac{3}{5}$.

17. $\frac{5}{44} \div \frac{7}{11}$.

10. $\frac{7}{48} \div \frac{8}{16}$.

14. $\frac{1}{12} \div \frac{5}{7}$.

18. $\frac{3}{8} \div \frac{9}{16}$.

19. What part of 25 is $6\frac{1}{2}$? Is $12\frac{1}{2}$? Is $18\frac{1}{2}$?

20. What part of 50 is $12\frac{1}{2}$? Is $37\frac{1}{2}$?

21. What part of 100 is $8\frac{1}{2}$? Is $16\frac{1}{2}$? Is $33\frac{1}{2}$? Is $58\frac{1}{2}$?

22. At $8\frac{1}{2}$ ¢ a pound, how many pounds of meat can be bought for \$1? For \$2? For $\$2\frac{1}{2}$? For \$5?

23. At $6\frac{1}{4}$ ¢ a yard, how many yards of muslin can be bought for \$1? For $\$1\frac{1}{2}$? For $\$3\frac{1}{4}$? For \$5?

24. At $12\frac{1}{2}$ ¢ a pound, how many pounds of lard can be bought for \$1? For $\$2\frac{1}{2}$? For \$5? For $\$7\frac{1}{2}$?

Change to larger units:—

1. $\frac{95}{76}, \frac{175}{128}$.

2. $\frac{68}{184}, \frac{112}{128}$.

3. $\frac{144}{110}, \frac{216}{112}$.

4. $\frac{288}{880}, \frac{960}{700}$.

5. $\frac{175}{155}, \frac{288}{88}$.

6. $\frac{85}{168}, \frac{152}{168}$.

Change to improper fractions:—

7. $42\frac{5}{8}, 53\frac{3}{4}$.

8. $49\frac{3}{7}, 63\frac{3}{4}$.

9. $153\frac{3}{8}, 242\frac{7}{8}$.

10. $48\frac{5}{16}, 63\frac{4}{17}$.

11. $78\frac{3}{11}, 96\frac{7}{11}$.

12. $93\frac{7}{11}, 108\frac{3}{16}$.

Change to whole or mixed numbers:—

13. $2\frac{88}{17}, 3\frac{47}{28}$.

16. $1\frac{288}{26}, 2\frac{97}{16}$.

19. $1\frac{243}{22}, 6\frac{84}{27}$.

14. $1\frac{73}{11}, 2\frac{61}{18}$.

17. $4\frac{97}{18}, 3\frac{47}{18}$.

20. $1\frac{576}{16}, 4\frac{88}{14}$.

15. $2\frac{48}{16}, 7\frac{88}{12}$.

18. $5\frac{27}{19}, 6\frac{41}{28}$.

21. $2\frac{68}{34}, 2\frac{71}{29}$.

Add:—

22. $17\frac{3}{8}, 14\frac{1}{8}, 17\frac{5}{8}$.

23. $18\frac{2}{8}, 19\frac{3}{8}, 13\frac{7}{12}$.

24. $43\frac{7}{8}, 63\frac{3}{8}, 64\frac{1}{2}$.

25. $175\frac{5}{8}, 49\frac{7}{8}, 84\frac{2}{11}$.

From:—

26. $73\frac{3}{8}$ take $16\frac{5}{12}$.

27. $91\frac{1}{2}$ take $73\frac{2}{8}$.

28. $77\frac{1}{2}$ take $19\frac{1}{8}$.

29. $84\frac{3}{4}$ take $15\frac{1}{8}$.

Multiply:—

30. $\frac{7}{11}$ by $\frac{4}{8}$.

31. $1\frac{3}{8}$ by $\frac{2}{17}$.

32. $3\frac{1}{8}$ by $2\frac{5}{8}$.

33. $9\frac{3}{8}$ by $\frac{1}{2}$.

Divide:—

34. $\frac{3}{8}$ by $\frac{3}{8}$.

35. $\frac{11}{4}$ by $\frac{2}{17}$.

36. $1\frac{3}{8}$ by $9\frac{2}{16}$.

37. $5\frac{7}{8}$ by $3\frac{1}{8}$.

1. If Harry is 12 years old and his father 48, how much older is the father? How many times as old? Harry's age is what part of his father's?

2. If one book cost \$2.00 and another \$1.50, compare their costs.

3. If 15 doz. eggs are worth \$3.15, what are 45 doz. worth?

SUGGESTION. Compare 15 and 45. Can you solve the problem without a pencil?

4. What is the ratio of 14 to 56? If 14 tons of coal cost \$119, how many times as much will 56 tons cost? What will 56 tons cost?

5. What is the ratio of 9 to 27? When 9 yards of cloth cost \$11.25, what will 27 yards cost? Can you solve this without a pencil?

6. What is the ratio of 3 to 12? If 12 bbl. of sugar cost \$237, what will 3 bbl. cost?

7. What is the ratio of 17 to 85? If 17 bu. of potatoes are worth \$14.45, what are 85 bu. worth? Can you solve this without a pencil?

8. What is the ratio of 16 to 64? If a bicyclist rides 16 miles in $1\frac{1}{4}$ hr., how long at this rate will it take him to ride 64 miles? Solve without a pencil.

9. What is the ratio of 12 to 36? If 12 cars will carry 285 tons, how many tons will 36 cars carry?

10. What is the ratio of 13 to 78? If I receive \$45.50 for 13 days' work, what should I receive for 78 days'?

11. If 3 hats cost a dealer \$6.75, what is the rate per dozen?

12. If an article weighing 18 lbs. costs \$1.52, what will one weighing 90 lbs. cost at the same rate?

1. What is the ratio of 3 pk. to 1 bu.? What will 3 pk. of apples cost at \$ 2.00 a bushel?

2. What is the ratio of 6 oz. to 1 lb.? What will 6 oz. of spices cost at 40¢ a pound?

3. What will 8 oranges cost at 45¢ a dozen?

4. What is the ratio of $\frac{1}{8}$ to $\frac{1}{4}$? If $\frac{1}{4}$ A. of land is worth \$ 32, what is $\frac{1}{8}$ A. worth?

5. What is the ratio of $\frac{3}{4}$ to $\frac{3}{8}$? If $\frac{3}{8}$ of a farm sells for \$ 1200, what will $\frac{3}{4}$ of the farm sell for at the same rate?

6. What is the ratio of $\frac{3}{8}$ to $\frac{3}{4}$? (*Hint.* Change to 24ths.) If $\frac{3}{8}$ of the distance to a certain place is 48 miles, what is $\frac{3}{4}$ the distance to that place?

7. What is the ratio of 8 to 6? If 6 cords of wood are worth \$ 15.75, what are 8 cords worth? (Since 8 is $1\frac{1}{3}$ times 6, 8 cords will cost $1\frac{1}{3}$ times \$ 15.75, or \$ 15.75 + $\frac{1}{3}$ of \$ 15.75. Now can you solve without a pencil?)

8. What is the ratio of 12 to 9? If 9 cars can carry 186 tons of coal, what can 12 cars carry? (Solve quickly by writing $\frac{4}{3}$ of 186 under 186 and adding.)

9. What is the ratio of 20 to 18? If 18 bushels of apples cost \$ 10.80, what will 20 bushels cost?

10. If $\frac{3}{8}$ of a farm is worth \$ 360, what is $\frac{5}{8}$ of it worth?

11. What is the ratio of $2\frac{1}{2}$ to 5? At 5 dozen pencils for \$ 2.40, what will $2\frac{1}{2}$ dozen cost?

12. If 6 cords of wood will give as much heat as 4 tons of coal, what can I afford to pay for wood when coal is \$ 7.50 a ton?

13. If a bird flies 1000 feet in 12 seconds, how far will it fly in 78 seconds?

1. When \$120 is paid for 15 bbl. of flour, what will be paid for 78 bbl. (What is the ratio of 78 to 15?)

REMARK. The ratio of one number to another is the same as the quotient of the first divided by the second.

2. If 6 men can mow a field in 5 days, how long will it take 3 men? What is the ratio of 6 to 3? How many times as long will half as many men require?

3. If 3 boys can mow a lawn in 3 hours, how long will it take 2 boys?

4. 27 men can build a bridge in 12 days. How long will it take 36 men? What is the ratio of 27 to 36?

Give the ratio of the following quantities:—

- | | |
|-----------------------|--|
| 5. 2 bbl. and 18 bbl. | 10. 21 da. and 30 da. |
| 6. 42 gal. and 7 gal. | 11. 1 lb. and 4 oz. |
| 7. \$8 and \$64. | 12. 6 in. and 2 yd. |
| 8. 1 ft. and 1 yd. | 13. $\frac{3}{4}$ ton and $3\frac{3}{4}$ tons. |
| 9. 1 bu. and 16 qt. | 14. $2\frac{1}{2}$ yd. and $7\frac{1}{2}$ yd. |

15. Make problems including the above quantities and solve them, or propose them to your classmates for solution.

Give the ratio of the following numbers:—

- | | | |
|--|---|---------------------------|
| 16. $\frac{9}{10}$ and $\frac{3}{5}$. | 20. $2\frac{1}{2}$ and $1\frac{1}{4}$. | 24. 5 and $\frac{1}{3}$. |
| 17. $\frac{1}{3}$ and 3. | 21. $1\frac{1}{3}$ and $4\frac{1}{2}$. | 25. 2 and $\frac{1}{4}$. |
| 18. $\frac{2}{3}$ and $\frac{3}{4}$. | 22. $2\frac{3}{8}$ and $1\frac{1}{4}$. | 26. 3 and $\frac{1}{3}$. |
| 19. $\frac{5}{7}$ and $1\frac{1}{2}$. | 23. $\frac{3}{7}$ and $\frac{9}{14}$. | 27. 5 and $\frac{1}{2}$. |

28. When $1\frac{1}{3}$ yards of velvet costs \$1.75, what will $4\frac{1}{2}$ yards cost?

In finding a product orally, it may be easier to multiply the highest number first; thus, $3 \times 46 = 3 \times 40 + 3 \times 6 = 138$.

1. $4 \times 68 = 240 + 32 = 272$; $3 \times 76 = \text{---}$.

2. $4 \times 98 = 4 \times 90 + 4 \times 8 = 392$; $6 \times 79 = \text{---}$.

In this way find: —

3. 5×96 .

6. 7×63 .

9. 5×94 .

4. 7×84 .

7. 2×97 .

10. 6×86 .

5. 6×72 .

8. 3×88 .

11. 7×46 .

12. To find $96 - 79$, it is easier to think $96 - 70 - 9 = 26 - 9 = 17$.

13. To find $356 - 179$, $356 - 170 - 8 = 186 - 8 = 178$.

In this way find: —

14. $96 - 68$.

17. $75 - 58$.

20. $347 - 218$.

15. $73 - 49$.

18. $138 - 67$.

21. $246 - 174$.

16. $64 - 38$.

19. $121 - 86$.

22. $360 - 245$.

23. To subtract 3684 from 10,000,

Observe that each number after 4 is subtracted from 9, and then the remainder 6316 can be written at once.

Subtract each of these from 10,000: —

24.

25.

26.

27.

28.

3896

7845

2463

7684

376

7843

6388

7896

3468

491

8961

9734

8479

984

847

29. To multiply 847 by 25.

Since $25 = \frac{1}{4}$ of 100, $25 \times 847 = \frac{1}{4}$ of $100 \times 847 = \frac{1}{4}$ of 84,700 = 21,175.

In this way find: —

30. 25×268 .

33. 25×783 .

36. 25×646 .

31. 25×347 .

34. 25×964 .

37. 25×732 .

32. 25×260 .

35. 25×382 .

38. 25×861 .

1. In changing $\frac{3}{4}$ to 12ths, how do you affect the size of the unit? Why do you have to increase the number of units?

2. In comparing $\frac{3}{4}$ yd. and 26 in., to what common unit do you change both?

3. To compare $\frac{5}{8}$ and $\frac{4}{9}$, to what common unit do you change each?

4. Which is larger, $\frac{475}{11}$ or $43\frac{6}{11}$? What change did you make before comparison?

5. Compare $\frac{1}{16}$ and $\frac{1}{4}$. If $\frac{1}{16}$ of a certain distance is 12 miles, what is $\frac{1}{4}$ of the distance?

6. Harry can walk $\frac{1}{6}$ of a mile while James rides $\frac{1}{4}$. How far will James ride while Harry walks 3 miles?

7. Compare $\frac{1}{32}$ and $\frac{1}{4}$. I spend $\frac{1}{32}$ of my money, or \$3 for a hat and $\frac{1}{4}$ of my money for a suit. What did the suit cost?

8. If $\frac{3}{16}$ of a farm is sold for \$800, what should $\frac{3}{8}$ sell for? (What is the ratio of $\frac{3}{16}$ to $\frac{3}{8}$?)

9. If $\frac{1}{2}$ of a ton of coal costs \$4.50, what will $\frac{1}{4}$ of a ton cost? $\frac{3}{4}$ of a ton? $1\frac{1}{4}$ tons? 2 tons?

10. Into how many pieces $\frac{5}{16}$ of a yard long can $6\frac{1}{4}$ yd. of ribbon be cut?

11. $\frac{2}{32}$ of my money, $\frac{2}{16}$ of it, plus $\frac{1}{4}$ of it, is what part of it?

12. Change to 32ds: $\frac{3}{4}$; $\frac{5}{8}$; $\frac{7}{16}$; $1\frac{3}{4}$; $\frac{9}{12}$.

13. I spent $\frac{5}{8}$ of my money for a house. What part had I left?

14. If I had \$3000 left, what did the house cost?

15. Compare $\frac{37}{7}$ with $\frac{37}{8}$. Do not change to like units. Find a shorter way.

1. Draw an oblong 3 times as long as wide. Divide it into 27 equal parts. What is each part called?

2. Show from your figure that $\frac{2}{3} = \frac{8}{9}$; that $\frac{2}{3} = \frac{1}{\frac{3}{2}}$.

3. Add $\frac{1}{3}$ and $\frac{2}{3}$; $\frac{2}{3}$ and $\frac{5}{7}$; $\frac{1}{3} + \frac{1}{9} + \frac{1}{7} = ?$

4. Compare $\frac{1}{3}$ and $\frac{1}{9}$; $\frac{1}{9}$ and $\frac{1}{7}$; $\frac{5}{9}$ and $\frac{5}{8}$; $\frac{7}{7}$ and $\frac{7}{9}$.

5. Show by a diagram that $\frac{2}{3} = \frac{4}{6}$; that $\frac{5}{6} = \frac{1}{\frac{6}{5}}$.

6. How many 9ths in 1? In $1\frac{2}{3}$? In $5\frac{1}{3}$? In $6\frac{2}{3}$?

7. If $\frac{1}{9}$ of your money is \$2, how much has Harry who has $2\frac{2}{3}$ times as much as you? (How many 9ths in $2\frac{2}{3}$?)

8. After spending $\frac{3}{4}$ of his money for a book and $\frac{1}{8}$ of it for a toy, a boy had 15¢ left. What did he spend for the book? For the toy?

9. A boy living 1 mile (320 rd.) from a school has what part of the distance to go after having gone 120 rd.?

10. A rectangle is divided into 9 equal parts. What fraction of the whole is each part? 3 of the parts? 6 of the parts? 4 of the parts? 5 of the parts?

11. Divide each 9th into 2 equal parts. What part of the whole is each part? 3 of these parts? 5 of these parts?

12. $\frac{1}{2}$ of $\frac{1}{3} = \text{---}$. $\frac{1}{3}$ of $\frac{1}{9} = \text{---}$. $\frac{1}{3}$ of $\frac{2}{3} = \text{---}$. $\frac{1}{2}$ of $\frac{5}{6} = \text{---}$.

Make problems of the following and ask members of the class to solve them:—

13. Cost of $\frac{1}{3}$ is —, the cost of $\frac{1}{4}$ will be.

14. When $\frac{2}{3}$ the distance is —, $\frac{4}{7}$ will be.

15. About $\frac{2}{3}$ lb. and $\frac{5}{6}$ lb. 18. About $\frac{3}{18}$ and $1\frac{5}{8}$.

16. About $\frac{2}{3}$ oz. and $\frac{1}{2}$ lb. 19. About $\frac{2}{3}$ of a mile and $\frac{1}{3}$ of a mile.

17. About \$ $\frac{1}{4}$ and \$ $\frac{5}{8}$. 20. About $\frac{1}{4}$ yd. and $2\frac{3}{4}$ yd.

1. A man owned $\frac{3}{4}$ of a farm and sold $\frac{1}{2}$ of his share for \$3645. At this rate what is the whole farm worth?
2. At \$1 $\frac{3}{4}$ per yard, what will 5 $\frac{1}{4}$ yd. cost?
3. If a boy can earn \$0.85 in 1 day, what can he earn in 8 $\frac{3}{4}$ days?
4. I buy 320 acres of land at \$45 per acre. I sell $\frac{7}{8}$ of it at \$60 and $\frac{1}{4}$ of it at \$55. How much have I left, and how much money has it really cost me?
5. A dealer sold 16 $\frac{3}{4}$ tons of coal for \$150.75. At this rate, what will 7 $\frac{1}{4}$ tons cost?
6. What is the ratio of 3 $\frac{3}{4}$ to 2 $\frac{1}{2}$? If 3 $\frac{3}{4}$ tons of hay cost \$35.50, what will 2 $\frac{1}{2}$ tons cost?
7. What is the ratio of $\frac{3}{8}$ to $\frac{5}{8}$? If a boy rides 16 miles in $\frac{3}{8}$ hr., how far can he ride in $\frac{5}{8}$ hr.?
8. If 6 $\frac{1}{4}$ acres yield 450 bushels of potatoes, what will 7 $\frac{1}{2}$ acres yield at the same rate?
9. If 12 men do a piece of work in 2 $\frac{1}{2}$ days, how many men will be required to do it in 3 $\frac{1}{2}$ days?
10. A well 36 ft. deep is $\frac{4}{5}$ filled. How long a rope will reach from the top of the well to the water?
11. Two ships 130 miles apart sail toward each other, one at the rate of 10 $\frac{1}{2}$ miles an hour, and the other at the rate of 8 $\frac{3}{8}$ miles. How far apart will they be at the end of 5 hours and 24 minutes? (Look at this carefully before using your pencil and try to find a short solution.)
12. When $\frac{3}{8}$ of a ton of hay is worth \$13, what should I pay for 5 $\frac{3}{8}$ tons? ($5\frac{3}{8} = \text{---} \times \frac{3}{8}$, hence the cost of 5 $\frac{3}{8}$ tons = $\text{---} \times \$13$.)
13. $\frac{3}{8}$ of Tom's weight is $\frac{1}{4}$ of his father's. If Tom weighs 65 lb., what does his father weigh?

	1.	2.	3.	4.	5.	6.	7.	8.
<i>a</i>	6	24	$\frac{1}{2}$	$\frac{4}{5}$	$4\frac{1}{5}$	$12\frac{1}{2}$	$19\frac{1}{5}$	$341\frac{1}{5}$
<i>b</i>	10	40	$\frac{1}{8}$	$\frac{5}{8}$	$6\frac{3}{4}$	$16\frac{3}{8}$	$19\frac{5}{12}$	$482\frac{5}{10}$
<i>c</i>	9	64	$\frac{1}{4}$	$\frac{3}{7}$	$8\frac{5}{8}$	$18\frac{3}{4}$	$16\frac{1}{2}$	$386\frac{5}{12}$
<i>d</i>	2	15	$\frac{1}{5}$	$\frac{8}{15}$	$7\frac{5}{12}$	$31\frac{1}{4}$	$24\frac{1}{8}$	$521\frac{1}{4}$
<i>e</i>	7	60	$\frac{1}{8}$	$\frac{7}{8}$	$8\frac{5}{8}$	$33\frac{3}{8}$	$24\frac{3}{4}$	$287\frac{1}{8}$
<i>f</i>	8	36	$\frac{1}{8}$	$\frac{7}{12}$	$9\frac{1}{8}$	$37\frac{1}{2}$	$41\frac{3}{8}$	$272\frac{1}{4}$
<i>g</i>	3	16	$\frac{1}{9}$	$\frac{5}{8}$	$6\frac{7}{8}$	$43\frac{3}{4}$	$36\frac{1}{12}$	$316\frac{7}{16}$
<i>h</i>	10	72	$\frac{1}{10}$	$\frac{2}{5}$	$7\frac{7}{10}$	$56\frac{1}{4}$	$45\frac{1}{5}$	$382\frac{7}{8}$
<i>i</i>	6	45	$\frac{1}{12}$	$\frac{11}{16}$	$10\frac{3}{8}$	$62\frac{1}{2}$	$48\frac{9}{16}$	$681\frac{3}{8}$
<i>j</i>	4	30	$\frac{4}{15}$	$\frac{3}{8}$	$11\frac{1}{8}$	$66\frac{3}{8}$	$52\frac{3}{4}$	$218\frac{3}{8}$
<i>k</i>	11	48	$\frac{3}{16}$	$\frac{5}{18}$	$12\frac{1}{12}$	$68\frac{1}{4}$	$60\frac{1}{5}$	$937\frac{7}{10}$
<i>l</i>	8	75	$\frac{5}{18}$	$\frac{9}{20}$	$5\frac{1}{8}$	$83\frac{3}{8}$	$62\frac{1}{15}$	$523\frac{5}{8}$
<i>m</i>	5	20	$\frac{1}{20}$	$\frac{2}{3}$	$2\frac{8}{15}$	$87\frac{1}{2}$	$66\frac{3}{8}$	$642\frac{5}{12}$
<i>n</i>	12	50	$\frac{4}{25}$	$\frac{5}{8}$	$3\frac{4}{15}$	$40\frac{1}{8}$	$72\frac{3}{4}$	$611\frac{3}{8}$
<i>o</i>	7	80	$\frac{5}{7}$	$\frac{8}{9}$	$1\frac{10}{21}$	$6\frac{1}{4}$	$80\frac{1}{7}$	$846\frac{1}{5}$
<i>p</i>	4	25	$\frac{4}{9}$	$\frac{7}{18}$	$3\frac{7}{10}$	$8\frac{1}{8}$	$69\frac{5}{12}$	$348\frac{1}{8}$
<i>q</i>	9	90	$\frac{7}{8}$	$\frac{14}{15}$	$6\frac{5}{12}$	$11\frac{1}{9}$	$75\frac{5}{8}$	$486\frac{3}{4}$
<i>r</i>	8	96	$\frac{9}{10}$	$\frac{4}{5}$	$8\frac{5}{8}$	$91\frac{3}{8}$	$84\frac{3}{8}$	$541\frac{1}{12}$
<i>s</i>	5	32	$\frac{3}{15}$	$\frac{7}{9}$	$5\frac{1}{5}$	$80\frac{1}{8}$	$90\frac{7}{24}$	$738\frac{9}{10}$
<i>t</i>	12	100	$\frac{4}{25}$	$\frac{3}{8}$	$7\frac{3}{10}$	$75\frac{7}{8}$	$37\frac{3}{20}$	$949\frac{3}{4}$

Suggestive exercises from the table. (See p. 133.)

- | | |
|---------------------------------|------------------------------------|
| 1-20. Col. 3 + Col. 4. | 121-140. Col. 5 + Col. 6. |
| 21-40. Col. 3 + Col. 5. | 141-160. Col. 8 - Col. 6. |
| 41-60. Col. 5 - Col. 4. | 161-180. Col. 8 - Col. 7. |
| 61-80. Col. 1 \times Col. 3. | 181-200. Col. 5 \times Col. 6. |
| 81-100. Col. 4 \times Col. 2. | 201-220. Col. 7 + Col. 5. |
| 101-120. Col. 2 \div Col. 4. | 221-240. Product of Cols. 3, 4, 5. |

THE DECIMAL PARTS OF A DOLLAR

1. Compare the values of \$1, 1 dime, 1 cent.
 2. $\frac{3}{10}$ of a dime = — cents; $\frac{4}{10}$ of a dollar = — dimes.
 3. $\frac{3}{100}$ of a dollar = — cents; $\frac{25}{100}$ of a dollar = — cents.
 4. Compare the value of $\frac{1}{2}$, 50 cents, and \$0.50.
 5. Compare the value of $2\frac{1}{2}$, $2\frac{25}{100}$, and \$2.25.
 6. What is the common way of writing a number of dollars and cents? Write 1 dollar and 25 cents.
 7. Write 2 dollars and 40 cents. 40 cents = — dimes.
 8. In \$2.45, which figure represents dollars? Which one dimes, or tenths of a dollar? Which one cents, or tenths of a dime?
 9. 45 cents is what part of a dollar? Read \$2.45 as dollars and hundredths of a dollar.
 10. Read \$1.75 as dollars, dimes, and cents, and as dollars and hundredths of a dollar.
- The point between dollars and cents is called the decimal point and separates the dollars from the parts of a dollar.*
11. The first figure at the right of the decimal point represents dimes or — of a dollar. The second figure at the right represents cents or — of a dollar.
 12. Read as dimes and cents, and then as tenths and hundredths of a dollar: \$0.45; \$0.86; \$0.54.
 13. Write in figures, using the dollar sign: three and seventeen hundredths dollars; five and eight tenths dollars.
 14. Read \$0.50 as cents, as dimes, as hundredths of a dollar, as tenths of a dollar.

1. If 10 marbles cost 1¢, 1 marble will cost what part of a cent?

2. If 1 marble costs $\frac{1}{10}$ of a cent, what will 2 marbles cost?

One tenth of a cent is called a mill.

3. How many mills in a cent? In 40 mills there are how many cents?

4. 10 cents = how many mills? 100 mills = —.

5. 1 cent = — mills; 1 dime = — mills; 1 dollar = — mills.

6. 20 mills = — cents; 200 mills = — dimes; 2000 mills = — dollars.

7. 1 mill = — of a cent; 1 mill = — of a dime; 1 mill = — of a dollar.

8. Mills are written in the *third* decimal place as *thousandths* of a dollar. Read \$4.375; \$0.625; \$0.063.

9. How many entire dollars in \$24.375? How many dimes, or *tenths* of a dollar? How many cents, or *hundredths* of a dollar? How many mills, or *thousandths* of a dollar.

10. Read the following as dollars and *hundredths* of a dollar: \$32.19; \$47.08; \$6.39; \$216.48; \$82.97; \$64.48.

11. Read the following as dollars and *thousandths* of a dollar: \$6.125; \$8.375; \$9.625; \$0.875; \$0.938.

12. Read the numbers in Ex. 11 as dollars, cents, and mills.

13. \$0.125 is how many cents and parts of a cent?

14. Which is more, \$0.375 or \$0.38? How much?

Using the dollar sign, write the following numbers: —

15. 50 hundredths of a dollar. 17. 285 thousandths of a dollar

16. 75 hundredths of a dollar. 18. 625 thousandths of a dollar.

1. Write in figures and add: two and three hundred seventy thousandths dollars, seven and twenty-eight thousandths dollars, and six and four tenths dollars.

2. From five and seven tenths dollars, take three and one hundred seventy-five thousandths dollars.

Read as dollars and parts of a dollar; add and read the results:—

3.	4.	5.	6.	7.
\$5.8	\$0.175	\$9.75	\$0.05	\$1.85
3.756	9.8	8.435	0.75	0.007
1.085	10.12	15.	0.375	0.08
0.63	0.075	6.85	9.3	0.903
<u>0.014</u>	<u>9.8</u>	<u>2.7</u>	<u>6.004</u>	<u>9.3</u>

Read as dollars and parts of a dollar and subtract:—

8.	9.	10.	11.	12.
\$8.735	\$7.53	\$5.7	\$6.75	\$9.
2.096	6.245	1.628	2.083	3.378
<u>2.096</u>	<u>6.245</u>	<u>1.628</u>	<u>2.083</u>	<u>3.378</u>

13. Write in columns and add: \$3.65, \$4.8, \$5.003, \$0.85, \$0.073, \$0.245, \$9.6.

14. From \$5 take \$2.685; from \$6.7 take \$3.085.

15. From six and three hundredths dollars take four and sixteen thousandths dollars.

Multiply and read results as dollars and parts of a dollar:—

16.	17.	18.	19.	20.
\$3.85	\$2.6	\$3.085	\$0.625	\$1.008
<u>14</u>	<u>23</u>	<u>17</u>	<u>43</u>	<u>16</u>
21.	22.	23.	24.	25.
\$0.096	\$0.803	\$9.7	\$0.97	\$0.097
<u>.75</u>	<u>126</u>	<u>59</u>	<u>59</u>	<u>59</u>

1. Compare 30 and 3.
2. What does the 3 in the first number represent?
3. What does the zero show?
4. What does 3 standing alone, as in the second number, represent?
5. Removing the two zeros from 800 divides it by what?
6. In the following numbers, tell what 8 stands for in each: 81 feet; 825 feet; 128 feet.
7. How can you tell whether 8 stands for 80 feet, 800 feet, or 8 feet?
8. In the number 111 feet, what does the 1 at the right represent? Tell what each of the other 1's stands for.
9. How does each 1 correspond in value to the next 1 at the right? The next 1 at the left?
10. Mark the middle 1 in some manner, as 1̄11 feet, and let it represent 1 foot. What will the 1 at the left represent? The 1 at the right?
11. In \$222, let the middle 2 stand for \$2. What will each of the other 2's represent?

The decimal point is used to show the location of ones' place. The first number written at the left of the point represents ones.

12. The first figure at the right of the decimal point is —; the second figure is —; the third is —.
13. Read the following: 3.2 ft.; 12.5 yd.; 1.25 bu.
14. Draw a line 20 inches long. Erase 0.2 of it; 0.3 of it.
15. Draw an oblong and divide it into tenths. Draw a heavy line around 0.3 of the oblong; around 0.5 of it.
16. Draw a line 10 inches long and another 0.8 as long; one 0.4 as long; one 0.5 as long.

17. Draw a square and divide it into 100 small squares. What part of the large square is each of the small ones?

18. Color 0.03 of the square, 0.15 of it, 0.07 of it.

19. What part of anything is 0.25 of it?

20. Do you understand what is meant by 3.25 yards?

21. Show your teacher a length equal to 3.25 yards.

22. Do you know what 0.528 ft. means? Is it more or less than $\frac{1}{2}$ ft.?

23. 10.625 tons of coal means to you about how much?

24. A ton of coal weighs 2000 lb. What will 0.001 of a ton weigh? 0.003 of a ton?

25. Do you think 0.001 is a large or a small fraction?

26. Which would you prefer, 0.1, 0.01, or 0.001 of a dollar?

Numbers written at the left of the decimal point are integers. They denote so many whole things.

Numbers written at the right of the decimal point are fractions. They denote equal parts of whole things.

Because these equal parts are tenths, hundredths, thousandths, etc., we call them decimal fractions, or, more briefly, decimals.

Read the following decimal fractions:—

27. 0.3 of a yr.; 0.03 of a yd.; 0.003 of a rd.; 0.27 of a dollar.

28. 0.7 of a yr.; 0.07 of a lb.; 0.007 of a ton; \$0.36.

29. In practice we do not write 0.3 of a yr., but simply 0.3 yr., 0.03 yr., etc. Write as a decimal $\frac{5}{16}$ ft.; $\frac{6}{100}$ yd.

30. Write the fractions in Exercises 27 and 28, using denominators.

Write the following, using denominators:—

31. 0.5; 0.17; 0.08; 0.25; 0.125; 0.008.

32. 0.36; 0.03; 0.003; 0.9; 0.90; 0.09.

READING AND WRITING DECIMALS

The order and names of integral and decimal units are shown in the following table:—

millions	hundred-thousands	ten-thousands	thousands	hundreds	tens	ones	decimal point	tenths	hundredths	thousandths	ten-thousandths	hundred-thousandths	millionths
2,	3	5	7,	6	8	3	.	3	8	6,	7	5	3

1. Read the following decimals and mixed decimals:—

0.38	0.097	0.004	2.08
0.275	0.006	9.0219	3.039
0.3864	6.3018	0.03614	7.346
2.0781	0.8000	3.09010	8.649

- 2-5. Find the sum of each column of the numbers above.

Write the following numbers as decimals and find their sum:—

6. $\frac{27}{100}$; $1\frac{8}{10}$; $\frac{64}{1000}$; $9\frac{176}{10000}$; $\frac{2476}{100000}$; $\frac{6}{10000}$; $\frac{84}{10000}$; $8\frac{28}{10000}$.
 7. $\frac{16}{100}$; $\frac{25}{1000}$; $7\frac{22}{100}$; $9\frac{36}{1000}$; $\frac{15}{1000}$; $\frac{247}{1000}$; $86\frac{5}{10}$; $9\frac{84}{100}$.
 8. From $8\frac{25}{100}$ subtract $1\frac{374}{1000}$.

WORK

EXPLANATION. We write units of the same order in columns. Since 8.25 there are no thousandths from which to take 4 thousandths, we take $\frac{1.374}{6.876}$ one of the 5 hundredths, which is 10 thousandths, and proceed as in subtraction of integers.

9. From $71\frac{85}{100}$ take $26\frac{237}{1000}$. 10. From $1\frac{8}{100}$ take $\frac{44}{1000}$.

1. Write from dictation and add : 3.406, 2.91, 0.304, 19.01, 23.004.
2. Subtract 0.0976 from 0.123.
3. Add 80.005, 0.093, 9.07, 0.903, 1.009, 2.102.
4. Add 25, 2.35, 0.058, 0.009, 0.09, 200.002, 193.6.

Express the following as decimals and add : —

5.	6.	7.	8.
$2\frac{5}{100}$	$3\frac{2}{100}$	$\frac{18}{1000}$	$\frac{46}{10000}$
$-3\frac{17}{1000}$	$200\frac{2}{1000}$	$\frac{73}{10000}$	$\frac{87}{100}$
$\frac{9}{100}$	$35\frac{1}{100}$	$\frac{184}{1000}$	$\frac{185}{10000}$
$7\frac{7}{1000}$	$96\frac{7}{100}$	$\frac{96}{100}$	$\frac{8}{10000}$
$8\frac{3}{100}$	$107\frac{3}{1000}$	$3\frac{4}{100}$	$\frac{8}{1000}$

Find the value of : —

9. $36.003 + 1.73 + 2.0063 - 18.768$.
10. $18.9 + 16.8 + 24.67 - 43.7692$.
11. $0.346 + 0.17 + 0.096 - 0.09637$.
12. I bought 4 loads of coal as follows : 2.365 tons, 2.190 tons, 1.9 tons, 2.54 tons. How much did I buy in all ?
13. Mr. Smith owns 121.625 acres. He has 42.3 acres in meadow land, 23.96 acres in oats, 13.04 in beans, 23.8 acres in corn, and has the remainder of the farm in pasture. How much pasture has he ?
14. Take the sum of 38.493, 89.06, and 87.5 from 217.7.
15. Take the sum of 0.045 and 0.45 from 1.
16. Add the difference between 3.4 and 0.89 to their sum.

Add and subtract as indicated and check by using sums of columns.

17. $17.035 - 8.0769 + 9.376 - 0.5789 = \text{—}$.
18. $8.004 - 5.0784 + 8.39 - 6.008 = \text{—}$.
19. $25.976 - 9.0989 + 7.68 - 3.9412 = \text{—}$.
20. $76.83 - 4.927 + 6.8 - 0.048 = \text{—}$.
21. $\underline{85.9} - \underline{6.052} + \underline{9.5} - \underline{6.9843} = \text{—}$.

ZEROS AT THE RIGHT OF A DECIMAL. EFFECT OF MOVING THE POINT

1. Compare \$0.5 and \$0.50.
2. Compare 0.12 ft. and 0.120 ft.
3. Compare \$3. and \$3.00.
4. Compare 2.5 with 2.500.
5. Does annexing zeros to a number change the value if the decimal point remains unchanged?

The value of a figure depends upon the order which it occupies. If the decimal point is not moved the order is not changed, and annexing zeros does not change the value.

6. Compare \$0.01 and \$1.00. \$1.00 is — times \$0.01.
7. Compare \$0.05 and \$5.00; \$2.35 and \$235.
8. What is 100 times \$4.30? What is $\frac{1}{100}$ of \$450?
9. What effect on the value of \$4.30 has the changing of the place of the decimal point, so that the number is \$430?
10. What is 10 times 2 ft.? How is 0.2 ft. affected by moving the point so that the number becomes 2 ft.? (We do not really write the decimal point when a number is an integer, but we consider it to be at the right of *ones*, thus 2 ft. might be written 2. ft.)
11. Compare 0.2 and 2; 0.3 and 3; 0.02 and 2; 0.05 and 5.
12. Compare 0.002 and 2; 0.006 and 6; 0.125 and 125.
13. Moving the decimal point one place to the *right multiplies* by —; moving it two places to the *right multiplies* by —; moving it — *multiplies* by 1000.

Multiply the following by 1000: —

14. 0.365; 0.045; 0.08; 1.06.
15. 5.345; 7.08; 8.08; 9.2.

Multiply by moving the decimal point : —

- | | | |
|------------------------|--------------------------|---------------------------|
| 1. 10×3.4 . | 6. 10×2.65 . | 11. 100×2.5 . |
| 2. 10×0.2 . | 7. 100×3.783 . | 12. 1000×0.065 . |
| 3. 100×1.25 . | 8. 100×0.1675 . | 13. 1000×0.17 . |
| 4. 100×3.04 . | 9. 1000×0.243 . | 14. 100×19.3 . |
| 5. 100×0.16 . | 10. 100×0.5 . | 15. 1000×0.67 . |

16. Compare \$50.00 and \$5.00. What change in the place of the decimal point will give $\frac{1}{100}$ of \$50?

17. What is $\frac{1}{100}$ of 800? What change is made in the place of the decimal point?

18. Moving the decimal point one place to the left in \$700 gives what? What part of \$700 is \$70?

19. Moving the decimal point two places to the left in 500 gives what? Compare 5 and 500.

20. Moving the decimal point *one* place to the *left divides* a number by —; moving it *two* places to the left *divides* by —; moving it three places *divides* by —.

Divide by moving the decimal point : —

- | | |
|-----------------------|--------------------|
| 21. \$9750 by 100. | 25. \$5.50 by 100. |
| 22. 3465 ft. by 1000. | 26. 3.54 by 100. |
| 23. 693.5 by 100. | 27. 34.6 by 1000. |
| 24. 67.3 by 100. | 28. 0.06 by 10. |

29. At \$10 each how many watches can I buy for \$1800?

30. An insurance company spent \$9400 for typewriters at \$100 each. How many did it purchase?

31. 1000 boxes weigh 6000 lb. What does one box weigh?

32. If 100 men earn \$300 in a day, what will 500 men earn in the same time?

1. When you divide a number by 10 the quotient is what part of the dividend?

2. 0.1 of 85 is found by dividing 85 by —.

3. 0.4 of 20 means what? 0.05 of 100 means what?

4. What is 0.4 of 20? 0.05 of 100?

5. When we speak of multiplying a number by $\frac{1}{2}$, do we really multiply the number, that is, really increase it?

6. What do we do to multiply by $\frac{1}{2}$? by $\frac{1}{4}$? by $\frac{1}{8}$?

The sign (\times) then when the multiplier is a fraction does not mean "times," but means "of" and must be read so. For example, 0.1×4.5 is read $\frac{1}{10}$ of $4\frac{5}{10}$.

7. $75 \div 100$, or $\frac{1}{100}$ of 75 = —. (Written 0.01×75 .)

Read and then find the value of:—

- | | | |
|-------------------------|-------------------------|-------------------------|
| 8. 0.1×20 . | 14. 0.1×6.5 . | 20. 0.02×5 . |
| 9. 0.2×20 . | 15. 0.2×6.5 . | 21. 0.04×3.5 . |
| 10. 0.01×400 . | 16. 0.1×3.2 . | 22. 0.5×0.25 . |
| 11. 0.03×400 . | 17. 0.02×3.2 . | 23. 0.8×12.5 . |
| 12. 0.01×80 . | 18. 0.01×2.5 . | 24. 0.6×0.25 . |
| 13. 0.04×80 . | 19. 0.04×2.5 . | 25. 0.05×2.4 . |

Written

26. Multiply 8.42 by 2.6.

PROCESS

$$\begin{array}{r}
 8.42 \\
 2.6 \\
 \hline
 5.052 \\
 16.84 \\
 \hline
 21.892
 \end{array}$$

EXPLANATION. $0.6 \times 0.02 = 0.012$; write 2 in *thousandths'* place and carry the 1 hundredth. $0.6 \times 0.4 = 0.24$; $0.24 + 0.01 = 0.25$; and thus proceed, keeping each figure in its proper order.

Find the value of:—

- | | | |
|---------------------------|---------------------------|-------------------------|
| 27. 6.45×25.23 . | 29. 0.54×2.8 . | 31. 0.36×3.7 . |
| 28. 1.25×9.36 . | 30. 0.126×3.48 . | 32. 1.08×2.4 . |

We often compare any number of things with a hundred; for example, a pupil misses 5 words in a *hundred*, or *five-hundredths* of all the words in the lesson. A business man gains a certain number of *hundredths* of his investment.

Since this particular decimal, hundredths, is used so much, it is generally called **per cent**, a phrase which means *hundredths* or *by the hundred*.

Instead of the decimal point we use the symbol % to stand for per cent. Thus, 0.45 may be written 45%.

1. If 0.08, or 8%, of a farmer's sheep were black, how many black sheep in a flock of 100?

2. How many of his sheep are white?

3. Write as decimals: 6%, 12%, 25%, 50%, 15%.

4. How many hundredths in 1? How many per cent in 1?

5. $1 = \frac{100}{100}$ or — %; 100% of anything is *all* of it.

Express as fractions and change to larger units:—

6. $25\% = \frac{25}{100}$ or $\frac{1}{4}$; $50\% = \frac{50}{100}$ or —; $75\% = \frac{75}{100}$ or —.

7. $20\% = \frac{20}{100}$ or —; $10\% = \frac{10}{100}$ or —; $5\% = \frac{5}{100}$ or —.

8. $12\frac{1}{2}$ is what part of 100? $12\frac{1}{2}\% = 0.12\frac{1}{2} = \frac{1}{8}$.

9. $37\frac{1}{2}$ is how many times $12\frac{1}{2}$? $37\frac{1}{2}\% = 0.37\frac{1}{2} = \frac{3}{8}$.

10. $62\frac{1}{2}\% = 50\% + 12\frac{1}{2}\% = \frac{1}{2} + \frac{1}{8} = \frac{5}{8}$.

11. $\frac{1}{8}$ of 100 = —. Then $33\frac{1}{3}\%$ = what part of 100?

12. $33\frac{1}{3}\% = 0.33\frac{1}{3} = \frac{1}{3}$; $66\frac{2}{3}\% = \frac{2}{3}$.

13. 25% of 40 = what? (25% of 40 = $\frac{1}{4}$ of 40 = —.)

14. 50% of 18 = what?

17. 75% of 24 = what?

15. 50% of 25 = —.

18. $66\frac{2}{3}\%$ of 12 = —.

16. $33\frac{1}{3}\%$ of 10 = —.

19. 25% of 45 = —.

20. Sarah's mark in spelling was 86%. How many words did she spell correctly out of 100? She missed — words.

21. Of a crew of 24 men 75% were lost in a shipwreck. How many were saved?

1. We find $\frac{1}{10}$ of a number by moving the decimal point — place to the —. 0.1 , or $\frac{1}{10}$, of $20 = 2$; 0.1 of $4.5 = 0.45$.

2. Compare 0.8 and 0.1 . Since 0.1 of $20 = 2$, 0.8 of $20 = \text{—} \times 2$ or —.

3. What is 0.4 of 80 ? 0.5 of 90 ? 0.6 of 70 ?

4. 5 times 7 tenths = — tenths, or — and — tenths.

5. What is 0.4 of 6 ? 0.5 of 8 ? 0.6 of 5 ?

6. Find 0.05 of 200 . What does 0.05 of a thing mean?

7. What does 5% mean? Write it as a decimal.

8. Find 5% of 300 . 1% of a number is found by moving the decimal point — places to the —.

9. What is 7% of 300 ? 8% of 600 ? 10% of 400 ?

Find the products in the following: —

10. 0.5×40 .

17. 20% of 500 .

24. 0.04×0.05 .

11. 5% of 600 .

18. 0.25×400 .

25. 0.4×0.05 .

12. 0.6 of 0.8 .

19. 0.7×0.9 .

26. 0.05×0.6 .

13. 0.3×0.9 .

20. 0.6×2.5 .

27. 0.05×0.06 .

14. 0.7×0.8 .

21. 0.5×0.12 .

28. 5% of 0.08 .

15. 0.12×1.2 .

22. 25% of 60 .

29. 5% of 0.09 .

16. 3% of 900 .

23. 50% of 600 .

30. 20% of 0.085 .

31. I had \$500, but spent 20% of it. How much did I spend? What $\%$ had I left?

32. In the examples given above compare the number of decimal places in the product with the sum of those in the two factors.

33. Take any example you wish and see whether what you observed to be true in the preceding examples is true in the one selected.

There will be as many decimal places in the product as the sum of the number of places in both factors.

1. Find 0.758 of \$18.25.

WORK

\$ 18.25	or	\$ 18.25
0.758		0.758
<u>\$.14600</u>		<u>\$.14600</u>
.9125		.9125
<u>12.775</u>		<u>12.775</u>
\$ 13.83350		\$ 13.83350

Observe that it is not necessary to write the decimal points in multiplier and multiplicand under each other, yet in some respects it is preferable to do so, and then before the first product figure is written, determine what place it should occupy, and write it in its proper place. The decimal point of the product is then fixed, and there is less danger of error.

Find the products in the following:—

- | | | |
|------------------------|----------------------------|------------------------------------|
| 2. 0.26×37.5 | 8. 4.05×9.32 . | 14. 125% of 62.5. |
| 3. 4.5×90.8 . | 9. 0.703×98.2 . | 15. 85% of 0.246. |
| 4. 6.5×37.2 . | 10. 0.97×9.63 . | 16. 0.83×2.64 . |
| 5. 35% of 9.6. | 11. 0.092×0.125 . | 17. 19% of 4.04. |
| 6. 82% of 10.8 | 12. 0.34×0.902 . | 18. $37\frac{1}{2}\%$ of 8.4. |
| 7. 37% of \$86. | 13. 1.908×0.62 . | 19. $0.8\frac{1}{2} \times 0.65$. |

20. Bought a house for \$5400, and gained 25% when I sold it. How much did I gain?

21. What had I left after paying out 45% of \$200?

22. I bought a farm of 98.64 acres at \$45.25 per acre. What did it cost me?

23. How many acres had I left if I sold 25% of the farm mentioned in Exercise 22?

24. What is 40% of the farm worth at \$48 per acre?

25. A man paid \$3200 for a house and sold it so as to gain 20% of what it cost. Find the gain and the selling price.

1. $2\frac{1}{2}$ lb. is what part of $12\frac{1}{2}$ lb.?
2. If $2\frac{1}{2}$ lb. of sugar costs 16 cents, what will $12\frac{1}{2}$ lb. cost?
3. If you cut $2\frac{1}{2}$ feet into 18 equal parts, what is the length of each part?
4. $\frac{5}{18}$ of $2\frac{1}{2}$ feet = what?
5. James jumps 6 ft. 8 in. His brother Henry out-jumps him by $\frac{3}{4}$ of a foot. How far does Henry jump?
6. If 71.64 cubic feet of water weigh 2 tons, how many cubic feet in 36 tons?

Express as common fractions and change to larger units: —

- | | | | |
|-----------|-------------|-------------|------------|
| 7. 0.25. | 10. 0.025. | 13. 0.216. | 16. 0.045. |
| 8. 0.375. | 11. 0.4325. | 14. 0.0336. | 17. 0.064. |
| 9. 0.625. | 12. 0.248. | 15. 0.875. | 18. 0.184. |

Find the value of: —

19. 3.65 tons of coal at \$8.50.
5.4 cords of wood at 4.25.
7.34 tons of coke at 6.75.
20. 3465 ft. of lumber at \$3.50 per M.
15,500 brick at \$8 per 1000.
26,250 shingles at \$3.75 per 1000.
21. Bought 0.32 of a farm of 160 acres and sold $37\frac{1}{2}\%$ of what I bought. How many acres had I remaining?
22. An article cost me \$285. I sold it for 28% more than it cost. What did I gain?

Multiply: —

- | | | |
|---------------------------|----------------------------|----------------------------|
| 23. 0.84×0.251 . | 27. 1.06×0.934 . | 31. 3.04×1.09 . |
| 24. 0.164×0.28 . | 28. 2.002×0.163 . | 32. 0.109×0.206 . |
| 25. $38\% \times 0.64$. | 29. 2.5×0.016 . | 33. 0.019×0.008 . |
| 26. 0.08×0.008 . | 30. 4.3×0.009 . | 34. 0.909×9.09 . |

1. Change 0.875 to a common fraction.
2. From a piece of cloth containing 55.5 yd. a merchant sold 18.75 yd. How much remained?
3. Arrange and add: 34.5, 5.34, 91.2, 6.75, 0.125.
4. Express the following as decimals and add: $\frac{7}{10}$, $1\frac{3}{10}$, $4\frac{75}{100}$, $\frac{33}{1000}$, $14\frac{3}{100}$, $6\frac{24}{1000}$.

Write in columns and add: —

5. $6.5 + 3.41 + 32.47 + 2.043 + 45$.
6. $0.453 + 2.49 + 13.027 + 0.648 + 0.068$.
7. $1.13 + 0.027 + 14.1 + 53. + 16.028$.

Find the difference and check your results: —

- | | | |
|---------------------|----------------------|------------------------|
| 8. $0.62 - 0.47$. | 11. $0.34 - 0.175$. | 14. $2.03 - 0.0046$. |
| 9. $0.78 - 0.29$. | 12. $3.46 - 1.887$. | 15. $1.034 - 0.0937$. |
| 10. $0.849 - 0.267$ | 13. $4.83 - 2.973$. | 16. $2.09 - 1.993$. |

17. Write as decimals and find the sum: —

4%; 6%; $2\frac{1}{2}\%$; $3\frac{1}{2}\%$; 25%; $23\frac{1}{2}\%$; 16.4%; 32.4%; 1.6%; 0.6%.

18. Add 8% of \$85.40 to 15% of \$63.90.

19. I sold an article that cost me \$34.50 at a gain of 24%. What did I get for it?

20. I bought a bicycle for \$37.50. After using it for 3 months, I sold it for 75% of what it cost me. What did I get for it?

21. In a school of 625 pupils, 40% are boys. How many girls in the school?

22. I pay \$0.07 for the use of \$1. What shall I pay for the use of \$375.50?

23. From 0.375×3.06 take 0.985×0.72 .

1. What is $\frac{1}{3}$ of 6 tenths? $0.6 \div 3 = \text{---}$
2. What is $\frac{1}{4}$ of 84 hundredths? $0.84 \div 4 = \text{---}$.

Find the value of the following:—

- | | | |
|--------------------|-----------------------|----------------------|
| 3. $0.96 \div 8$. | 7. $0.025 \div 5$. | 11. $4.08 \div 8$. |
| 4. $0.36 \div 9$. | 8. $0.048 \div 8$. | 12. $6.44 \div 7$. |
| 5. $4.8 \div 4$. | 9. $6.024 \div 6$. | 13. $0.84 \div 12$. |
| 6. $12.9 \div 3$. | 10. $0.924 \div 12$. | 14. $9.63 \div 9$. |

15. 3 in 9 — times. Multiplying both dividend and divisor by 2, we have 6 in 18 — times; multiplying them both by 4, we have 12 in 36 — times.

16. Is the quotient changed when we *multiply* both dividend and divisor by the same number?

17. 12 in 48 — times. Dividing both dividend and divisor by 2, we have 6 in 24 — times; by 4, and we have 3 in 12 — times.

18. Is the quotient changed when we divide both dividend and divisor by the same number?

Principle in Division. *Multiplying or dividing both dividend and divisor by the same number does not change the quotient.*

19. How many times is 0.2 contained in 2.4?

SUGGESTION. 0.2 in 2.4 is the same as 2 in 24, for both dividend and divisor have been multiplied by 10.

20. Divide 0.96 by 0.8. The divisor may be made an integer by multiplying it by —, or by moving the decimal point — place to the —. Since the divisor was multiplied by 10, we also multiply the dividend by 10 in order not to change the quotient. Now we have $9.6 \div 8$, an exercise like those at the top of the page.

- | | | |
|----------------------|-----------------------|-----------------------|
| 21. $4.2 \div 0.7$. | 22. $0.63 \div 0.9$. | 23. $0.84 \div 1.2$. |
|----------------------|-----------------------|-----------------------|

1. How many times is 0.6 contained in 6.48 ?
2. How many times is 0.06 contained in 1.44 ?

WORK

$$0.06 \overline{)1.44} = 6. \overline{)144} \\ \underline{24}.$$

EXPLANATION. Here we multiply both dividend and divisor by 100.

Find the value of the following:—

- | | | |
|----------------------|------------------------|-------------------------|
| 3. $3.28 \div 0.4.$ | 7. $300 \div 0.06.$ | 11. $25 \div 0.005.$ |
| 4. $0.049 \div 0.7.$ | 8. $7.2 \div 12.$ | 12. $0.125 \div 0.005.$ |
| 5. $0.216 \div 0.9.$ | 9. $14.4 \div 1.2.$ | 13. $0.096 \div 0.08.$ |
| 6. $6.4 \div 0.08.$ | 10. $10.8 \div 0.009.$ | 14. $0.108 \div 0.09.$ |
15. How many times is 1.44 contained in 1.728 ?

WORK

$$1.44 \overline{)1.728} = 144 \overline{)172.8} \\ \underline{144} \\ 28.8 \\ \underline{28.8}$$

EXPLANATION. We multiply both dividend and divisor by 100 by moving the point two places to the right.

The point in the quotient is directly over the point in the dividend.

Should there be a remainder, zeros may be annexed in the dividend and the division continued.

- | | |
|--------------------------|--------------------------------------|
| 16. $26.6 \div 1.6.$ | 23. $12.6 \div 0.36.$ |
| 17. $\$32 \div \$0.625.$ | 24. $2.5 \div 0.625.$ |
| 18. $1.6 \div 0.625.$ | 25. $0.381 \div 1.9.$ |
| 19. $17.28 \div 1.44.$ | 26. $\$6.75 \div \$0.12\frac{1}{2}.$ |
| 20. $0.8 \div 1.6.$ | 27. $8.4 \div 14\%.$ |
| 21. $1.296 \div 0.36.$ | 28. $17.5 \div 25\%.$ |
| 22. $7.2 \div 120.$ | 29. $2.56 \div 0.016.$ |
30. How many pounds of tea at \$0.36 may be bought for \$3.24 ?
31. If 35.84 cubic feet of water weighs 1 ton, how much will 2458.6 cubic feet weigh ?

170 TO CHANGE A COMMON FRACTION TO A DECIMAL

1. $3 \div 8$, or $\frac{1}{8}$ of 3, $= \frac{3}{8}$.
2. Divide 3 by 8 as division of decimals.

WORK

$$\frac{3}{8} = 3 \div 8 = 8 \overline{)3.00} \\ 0.375$$

$$\text{Check. } 0.375 = \frac{375}{1000} = \frac{75}{200} = \frac{3}{8}.$$

Then $\frac{3}{8} = 0.375$.

Change to decimals and check:—

- | | | | |
|---------------------|----------------------|-----------------------|-----------------------|
| 3. $\frac{1}{4}$. | 7. $\frac{1}{16}$. | 11. $\frac{3}{8}$. | 15. $\frac{11}{16}$. |
| 4. $\frac{1}{8}$. | 8. $\frac{2}{5}$. | 12. $\frac{15}{16}$. | 16. $\frac{17}{16}$. |
| 5. $\frac{7}{8}$. | 9. $\frac{7}{16}$. | 13. $\frac{17}{16}$. | 17. $\frac{11}{16}$. |
| 6. $\frac{1}{12}$. | 10. $\frac{7}{16}$. | 14. $\frac{9}{16}$. | 18. $\frac{2}{5}$. |
19. Change $\frac{5}{8}$ to a decimal.

$$\text{PROCESS. } 6 \overline{)5.000} \quad \text{or} \quad 6 \overline{)5.00} \\ 0.833+ \quad \quad 0.83\frac{1}{2}$$

We may either use the + to show an undivided remainder, or give the quotient exactly as a complex decimal.

Change to decimals:—

- | | | | |
|---------------------|----------------------|----------------------|-----------------------|
| 20. $\frac{2}{3}$. | 23. $\frac{5}{12}$. | 26. $\frac{2}{18}$. | 29. $\frac{11}{12}$. |
| 21. $\frac{1}{6}$. | 24. $\frac{7}{12}$. | 27. $\frac{5}{7}$. | 30. $\frac{2}{17}$. |
| 22. $\frac{2}{3}$. | 25. $\frac{4}{5}$. | 28. $\frac{1}{18}$. | 31. $\frac{5}{11}$. |
32. Reduce $5\frac{1}{2}$ to a mixed decimal.

$$\frac{1}{2} = 0.75, \text{ then } 5\frac{1}{2} = 5.75.$$

Reduce to mixed decimals:—

- | | | |
|-------------------------|-----------------------|------------------------|
| 33. $5\frac{1}{2}$. | 36. $4\frac{1}{2}$. | 39. $6\frac{1}{2}$. |
| 34. $3\frac{1}{2}$. | 37. $13\frac{1}{2}$. | 40. $17\frac{1}{2}$. |
| 35. $9\frac{54}{100}$. | 38. $7\frac{4}{10}$. | 41. $19\frac{5}{11}$. |
42. Add $\frac{1}{4}$, 0.085, 0.173 and $1\frac{2}{8}$.

1. Divide 0.36 by 0.06, 60, and 1.8, and add the three quotients.
2. I bought a farm of $256\frac{1}{8}$ acres and sold 189.75 acres of it. Find the part of the farm that remained and express it as a decimal.
3. Divide 0.36 by 0.009, and 0.25 by 0.05, and add the quotients.
4. Divide 27 by $2\frac{3}{4}$.
5. Compare $4\frac{1}{2}$ with $22\frac{1}{2}$.
6. Take $\frac{5}{8}$ of 0.3 from 8.4 times $\frac{7}{12}$.
7. A farmer raised 28 bushels of wheat to the acre last year. This was $\frac{7}{8}$ of what he raised the year before. If he had 75 acres in wheat each year, what was his total crop for the two years?
8. If a boy runs 100 yards in $1\frac{1}{4}$ minutes, what is his rate per hour?
9. Divide $\frac{4}{5}$ of $37\frac{1}{2}$ by the difference between $24\frac{1}{2}$ and $18\frac{1}{4}$.
10. Take the sum of 38.495, 89.06, and $87\frac{3}{4}$ from $216\frac{3}{8}$.
11. My gas bill is 25% higher this month than last. It is \$4.50 this month; what was it last?
12. If 71.68 cubic feet of water weighs 2 tons, what will 1218.56 cubic feet weigh?
13. An express train runs 480 miles in $10\frac{1}{2}$ hours. How far will it run in $3\frac{1}{2}$ hours?
14. Sold $\frac{1}{2}$ yd., $3\frac{3}{4}$ yd., and 21.125 yd. from a piece of matting containing $49\frac{7}{8}$ yd. How many yards remained?
15. What number multiplied by 0.024 times 0.06 will equal 5.76?
16. A suburban lot of land contains 18,000 sq. ft. One third of it sold at 25¢ a square foot, $\frac{2}{3}$ of it at 30¢, and the remainder at 28¢. What was received for the whole lot?
17. I spent $\frac{1}{3}$ of my money on Monday and $\frac{1}{2}$ the remainder on Tuesday. I then had \$24. What did I have originally?
18. What will a pair of chickens weighing 8.625 lb. cost at $16\frac{2}{3}$ ¢ a pound?
19. Divide $16\frac{1}{8}$ by $8\frac{1}{8}$ and multiply the result by $0.37\frac{1}{2}$.

1. If \$5 is 1% of my money, how much is 100%, or all of my money?

2. If \$24 is 6% of my money, 1% of it is what? All of it is how much?

3. 5% of a crop of apples was 35 bushels. How many bushels in the whole crop? 100% of anything, or *all* of it, is how many times 5% of it?

4. 0.03 of the distance to a certain place is 6 miles. How far is it to the place?

5. 0.3 of my wheat was destroyed. This was 90 bushels; how many bushels had I at first? How many remained?

6. I made 0.2 of the cost, or \$16, on the sale of a horse. What did the horse cost me?

How much money have I if:—

7. 2% of it = \$6?

13. 5% of it = \$20?

8. 1% of it = \$2.50?

14. 6% of it = \$30?

9. 3% of it = \$15?

15. 8% of it = \$48?

10. 2% of it = \$7?

16. $12\frac{1}{2}\%$ of it = \$32?

11. 3% of it = \$21?

17. 25% of it = \$50?

12. 4% of it = \$12?

18. 25% of it = \$16?

19. 4 is $\frac{1}{2}$, or 50%, of 8.

23. 4 is — % of 40.

20. 9 is $\frac{1}{4}$, or 25%, of 36.

24. 6 is — % of 12.

21. 8 is 25% of —.

25. 8 is — % of 32.

22. 7 is 50% of —.

26. 10 is — % of 100.

27. James missed 6 words out of 30. This was $\frac{1}{5}$, or — %.

28. Ellen spelled 16 out of 20 correctly. This was $\frac{4}{5}$ of them, or — %.

29. Henry bought a knife for 50¢, and sold it for 40¢. What part of the cost did he lose? What %?

30. Bought a farm for \$1500, and sold it for \$1800. What part of the cost was the gain? What %?

1. Find the cost of 2490 lb. of coal at \$8.00 a ton of 2000 lb.

SUGGESTION. 1000 lb. is what part of a ton? What will 1000 lb. cost? 1000 is contained in 2490 how many times? How can you find this by moving the decimal point?

2. A creditor receives \$0.75 for every \$1.00 due him. He loses \$301.50. What was the sum due him?

3. I bought a farm for \$6400, and sold it at a loss of $12\frac{1}{2}\%$ of the cost. What did I get for it? (See whether you can discover a shorter method than multiplying by 0.125 to get $12\frac{1}{2}\%$ of \$6400.)

4. A merchant sold a quantity of coffee at a gain of 30% on the cost. The gain was \$13.80. What did the coffee cost?

5. Coffee bought at 25¢ a pound sold for 30¢ a pound. The gain on each pound was what part of the cost? Express your answer as a common fraction, a decimal, and a per cent.

Find the cost of a bill of goods when a gain of:—

6. 20% of the cost = \$18.40. 9. 15% of the cost = \$48.

7. 33% of the cost = \$69.30. 10. 16% of the cost = \$65.60.

8. 27% of the cost = \$56.70. 11. 3% of the cost = \$13.26.

12. Property costing \$6345 sold for \$6897. Find the gain on each \$100 invested.

13. A grocer paid \$13.95 for a barrel of sugar weighing 310 pounds. Find the cost per pound.

14. At what price per pound must the sugar mentioned in Exercise 13 be sold to gain 20%?

15. I bought a horse for \$100, and sold him for \$123. What did I gain? What part of the cost did I gain? What per cent of the cost was gained?

16. A grocer buys canned corn at \$1.20 per dozen, and sells it at a gain of 40%. What is the selling price per can?

17. If you buy a gun for \$13.75 and sell it so as to gain 20%, what is the selling price?

18. At \$0.16 $\frac{2}{3}$ a yard, how many yards of ribbon may be bought for \$4.25?

HINT. How many times \$0.16 $\frac{2}{3}$ will equal \$1, or how many yards can be bought for \$1?

19. If 0.75 of a pound of pepper is put into a single package, how many packages will 174 pounds make?

20. Divide 0.1875 of 2.56 by 6 $\frac{1}{4}$ %.

Find the amount of the following purchases:—

21. 7 $\frac{1}{2}$ yd. @ \$0.62 $\frac{1}{2}$.

22. 20 lb. @ \$0.007.

3 $\frac{1}{2}$ yd. @ \$0.50.

60 lb. @ $\frac{3}{4}$ ¢.

2 $\frac{1}{2}$ doz. @ \$0.75.

$\frac{1}{2}$ doz. @ \$0.37 $\frac{1}{2}$.

23. Take the sum of 12 $\frac{1}{2}$ %, 37 $\frac{1}{2}$ %, and 6 $\frac{1}{4}$ % from 100%.

24. How many rods and feet in 1200 feet, one rod being 16.5 ft. in length?

25. By selling a bicycle for \$15 less than it cost, I lose 37 $\frac{1}{2}$ %. What did it cost? ($\frac{3}{8}$ of the cost = \$15. Why?)

26. 0.34 of a farm of 185.4 acres is woodland, 0.24 of it is pasture and the remainder farming land. How many acres of farming land?

27. What decimal part of 8.5 qt. is 3 qt.?

28. Find what part of 3 bu. 2 pk., 6 pk. are, and express it as a decimal fraction.

29. Find 0.73 of 84.96 and divide the result by 0.087.

Arrange in columns and add:—

30. 3.1416 + 15.08 + 0.0937 + 86.7 + 13.086.

31. 0.047 + 0.16 + 0.009 + 34.6 + 25.001.

(See page 163)

1. The phrase *per cent* means ——. 6% of anything means $\frac{6}{100}$ of it.
2. 6% of \$ 200 means $\frac{6}{100}$ of \$ 200, or — times 0.01 of \$ 200.
3. 5% of \$ 300 = $5 \times$ — of \$ 300, or $5 \times$ \$ —, or —.
4. 5% of 400 feet = $\frac{5}{100}$ of —, or —.
5. How many 100ths in anything? How many per cent?
6. 50% of anything is what part of it?
7. 25% is what part of anything?
8. Draw an oblong and show your teacher 25% of it; 50% of it; 75% of it.
9. A pole is 36 feet high. What is the height of a pole 50% as high? 25% as high? 75% as high?
10. Compare $12\frac{1}{2}\%$ and 25%. Since $25\% = \frac{1}{4}$, what does $12\frac{1}{2}\%$ equal?
11. Compare $6\frac{1}{4}\%$ and $12\frac{1}{2}\%$. Since $12\frac{1}{2}\% = \frac{1}{8}$, what does $6\frac{1}{4}\%$ equal?
12. A pole is 72 feet high. How high is one 50% as high? One 25% as high? One $12\frac{1}{2}\%$ as high?
13. James has 32 cents. He spent 25% of it for a writing tablet, and $6\frac{1}{4}\%$ of it for a pencil. What did the tablet cost? What did the pencil cost?
14. What is 25% of 400 yards?
15. Edwin has 48 hens. Harry has $12\frac{1}{2}\%$ as many. How many has Harry?
16. What is $6\frac{1}{4}\%$ of 64 yards?
17. What is 7% of \$ 500?

1. What is 1% of \$900? To find $\frac{1}{100}$ of a number we move the decimal point — places to the —.
2. What is 1% of \$2000? What is 2% of 2000 ft.?
3. 6% of 500 ft. = what? 6% of 1200 sheep = —.
4. $12\frac{1}{2}\%$ of 96 bu. is how many bushels?
5. In Exercise 3 it was easier to find — of 500 ft. and then find 6%. In Exercise 4 it was easier to think $12\frac{1}{2}\% = \frac{1}{8}$ of 96.
6. A house cost \$2000. The lot cost 15% as much. What did the lot cost?
7. A horse cost \$160. A harness cost $12\frac{1}{2}\%$ as much. What did the harness cost?
8. Find $6\frac{1}{4}\%$ of 160 bushels; of 96 miles.

Find: —

- | | |
|-------------------------------|----------------------|
| 9. 50% of 300. | 14. 8% of \$900. |
| 10. 25% of 840. | 15. 10% of 346 ft. |
| 11. $12\frac{1}{2}\%$ of 960. | 16. 20% of 450 yd. |
| 12. $6\frac{1}{4}\%$ of 320. | 17. 7% of 600 acres. |
| 13. 75% of 24. | 18. 9% of 800 in. |
19. Compare $33\frac{1}{3}\%$ with 100%. What part of anything, then, is $33\frac{1}{3}\%$ of it?
 20. What is $33\frac{1}{3}\%$ of 90 feet?
 21. Compare $16\frac{2}{3}\%$ with $33\frac{1}{3}\%$. What part of anything is $16\frac{2}{3}\%$ of it?
 22. A lot is 96 feet wide. How wide is one $33\frac{1}{3}\%$ as wide? One $16\frac{2}{3}\%$ as wide?
 23. Compare $8\frac{1}{3}\%$ with $16\frac{2}{3}\%$. What part of anything is $8\frac{1}{3}\%$ of it?

1. A man bought a farm for \$3600 and sold it at a gain of 12%. Find the gain.

WORK

$$\begin{array}{r}
 \$3600. \\
 .12 = 12\% \\
 \hline
 \$72.00 \\
 360.0 \\
 \hline
 \$432.00
 \end{array}$$

$$\begin{array}{r}
 \text{or} \quad \$36 = 1\% \text{ of } \$3600. \\
 12. \\
 \hline
 \$72. \\
 360. \\
 \hline
 \$432.
 \end{array}$$

2. If the shrinkage of wheat in drying amounts to 5%, what is the shrinkage on 15,640 bushels?

3. A merchant received 6785 yards of silk. 16% was of foreign manufacture. How many yards were of domestic manufacture?

4. A farmer has a crop of 480 bushels of potatoes. He sells 45% of them at 60 cents a bushel, and the remainder at 55 cents. What does he get for his crop?

5. Find 28% of 348 bushels of grain.

6. Find 35% of 746 tons of coal.

7. A man commenced business with \$4800 and added 12½% as much more during the year. What was his total capital then?

8. The population of a certain city ten years ago was 13,400. It has increased 38%. What is its population now?

9. A man bought a horse for \$250. He sold it at a loss of 8%. What did he get for it?

10. A farmer raised 936 bushels of beans. He sold 33⅓% of them at \$1.40 per bushel and the remainder at \$1.53. What did he get for the whole crop?

11. A trader bought 640 sheep from one man and 75% of this number from another. How many did he buy all together?

12. How many sheep bought in Exercise 11 were left after 37½% of the number were sold?

1. A dealer buys coats at \$30 per dozen and wishes to sell them so as to gain 40% of the cost. At what price each shall he mark them?
2. 70% of a certain ore is iron. How many pounds of iron in $3\frac{1}{2}$ tons of the ore?
3. A mechanic receiving \$72 per month got an increase of $12\frac{1}{2}\%$. What did he then receive?
4. If unseasoned wood is 20% water, what will 85 tons of unseasoned wood weigh when seasoned?
5. A farmer shipped 150 crates of strawberries to an agent in Chicago, who sold them for \$1.80 per crate. If the agent charged 5% of the sales for his fee, what did he remit the shipper?
6. A book dealer buys books listed at \$264. Because he deals in books the company deducts 20% from the list price, or gives him a "trade discount" of 20%. Find what the books cost the dealer.
7. By paying $1\frac{1}{4}\%$ of the value of my house to an insurance company, it agrees to make good any loss by fire that may occur within three years from the date of the agreement. What will it cost me to insure my house valued at \$5600?
8. I employ an agent to buy some goods for me. If I pay him 2% of the cost of the goods purchased, how much money shall I send him if he is to purchase \$345 worth of goods?
9. I pay a per cent of the value of my property, or a tax, to help support the schools of my town. If my property is worth \$9680, what are my taxes if the rate is $1\frac{1}{8}\%$?
10. A farmer bought 520 sheep last year and they have increased 40% of their number. How many does he now have?
11. Make a drawing of the floor of a room 18 ft. long and 15 ft. wide. Represent its center covered by a rug 6 ft. wide and 9 ft. long. What fractional part of the floor is uncovered?

1. What part of \$16 is \$8? $\frac{1}{2} = \text{---}\%$.
2. \$8 is what part of \$32? $\frac{1}{4} = \text{---}\%$.
3. What per cent of \$32 is \$8?
4. 5 ft. is what part of 25 ft.? What per cent?
5. 15 is what part of 60? What %?
6. $\frac{1}{2} = \frac{50}{100} = 0.50 = 50\%$; $\frac{1}{4} = \frac{25}{100} = 0.25 = \text{---}\%$.
7. $\frac{3}{4} = 0.75 = 75\%$; $\frac{2}{5} = 0.40 = \text{---}\%$.
8. $\frac{1}{8} = 0.12\frac{1}{2} = \text{---}\%$; $\frac{1}{3} = 0.33\frac{1}{3} = \text{---}\%$.

Express the following as per cents:—

9. $\frac{3}{8}$. 11. $\frac{1}{8}$. 13. $\frac{5}{8}$. 15. $\frac{3}{8}$. 17. $\frac{2}{3}$.
10. $\frac{5}{8}$. 12. $\frac{2}{3}$. 14. $\frac{7}{8}$. 16. $\frac{4}{5}$. 18. $\frac{1}{9}$.
19. What part of 24 is 18? 18 is what % of 24?
20. 16 is what part of 40? 16 is what % of 40?
21. I bought a horse for \$100 and sold it for \$80. How many dollars did I lose? What per cent of \$100 did I lose?

Some fractions and some per cents are so often used in business that we should be able to give their value in different forms at sight.

Therefore, learn this

Table

$\frac{1}{2} = 50\%$.	$\frac{2}{5} = 40\%$.	$\frac{1}{8} = 12\frac{1}{2}\%$.	$\frac{1}{15} = 6\frac{2}{3}\%$.
$\frac{1}{3} = 33\frac{1}{3}\%$.	$\frac{3}{5} = 60\%$.	$\frac{3}{8} = 37\frac{1}{2}\%$.	$\frac{1}{10} = 10\%$.
$\frac{2}{3} = 66\frac{2}{3}\%$.	$\frac{4}{5} = 80\%$.	$\frac{5}{8} = 62\frac{1}{2}\%$.	$\frac{2}{15} = 13\frac{1}{3}\%$.
$\frac{1}{4} = 25\%$.	$\frac{1}{6} = 16\frac{2}{3}\%$.	$\frac{7}{8} = 87\frac{1}{2}\%$.	$\frac{1}{10} = 10\%$.
$\frac{3}{4} = 75\%$.	$\frac{5}{6} = 83\frac{1}{3}\%$.	$\frac{1}{12} = 8\frac{1}{3}\%$.	$\frac{1}{50} = 2\%$.
$\frac{1}{5} = 20\%$.	$\frac{1}{7} = 14\frac{2}{7}\%$.	$\frac{1}{18} = 5\frac{5}{9}\%$.	$\frac{3}{50} = 6\%$.

1. If I buy a lot for \$1600 and sell it for \$1800, what per cent do I make on the cost?

SUGGESTION. The gain is \$200; \$200 is $\frac{1}{8}$ of \$1600; $\frac{1}{8} = \text{---}\%$

2. A boy bought a bicycle for \$50 and sold it for \$55. What part of the cost did he gain? What per cent did he gain?

3. What per cent shall I gain by selling an article that cost \$2400 at a gain of \$600?

HINT. What part of \$2400 is \$600?

4. A merchant buys canned corn at 90¢ a dozen and retails it at 10¢ a can. What per cent does he make?

5. Out of 75 words, Mary misses 9. What per cent does she have correct?

6. What per cent should one receive on a spelling lesson when 20 words are missed out of 150?

7. What per cent of 480 is 220?

8. What per cent of 1980 miles is 346.5 miles?

WORK

$$\begin{array}{r}
 0.175 = 17\frac{1}{2}\% \\
 1980 \overline{)346.50} \\
 \underline{198.0} \\
 159.50 \\
 \underline{138.60} \\
 9.900 \\
 \underline{9.900}
 \end{array}$$

EXPLANATION. The part that 346.5 is of 1980, or the ratio of 346.5 to 1980 is $\frac{346.5}{1980}$. This expressed as a decimal is 0.175 or 17.5%.

Remember that the per cent one number is of another is simply their ratio expressed as hundredths by the sign %.

9. A farm that cost \$3900 sold for \$3675. What was the loss per cent?

10. What would the farm have sold for at a gain of 27%?

11. What would the selling price have been had the loss been 13½%?

12. I bought goods for \$320 and sold them for \$400. What per cent of the cost was gained?

1. What is the relation of all, or 100%, of anything to 25% of it? $100\% = \text{---} \times 25\%$.

2. If 25% of the height of a pole is 10 ft., how high is it?

3. Compare 100% with $12\frac{1}{2}\%$. If $12\frac{1}{2}\%$ of the cost of a bicycle is \$4, what did it cost?

HINT. The cost = $\text{---} \times 12\frac{1}{2}\%$ of it or $\text{---} \times \$4$.

4. Compare all of anything with $16\frac{2}{3}\%$ of it. $16\frac{2}{3}\%$ of a certain length is 5 ft. What is the length? $\text{---} \times 5 \text{ ft.} = \text{---} \text{ ft.}$

5. Compare all of anything with $8\frac{1}{3}\%$ of it. If 3 years is $8\frac{1}{3}\%$ of my age, how old am I?

6. Compare 100% with $33\frac{1}{3}\%$; 100% with $6\frac{1}{4}\%$.

7. $12\frac{1}{2}\%$ of the cost of a house is \$150. What did it cost?

8. I sold my watch at a gain of \$6. This was $12\frac{1}{2}\%$ of the cost. What was the cost?

9. A farmer sold 15 sheep. This was $16\frac{2}{3}\%$ of his flock. How many had he?

10. Compare all, or 100%, of anything with 20% of it.

11. A boy missed 8 words in his spelling lesson. This was 20% of the lesson. How many words in the lesson?

12. A boy sells 90% of his papers. How many per cent does he have left?

13. A boy sold 90% of his papers and had 6 left. How many had he at first?

HINT. 6 papers = 10% of what he had at first. Why?

14. I sold a bicycle at a gain of \$8. This was 20% of the cost. What did it cost me?

15. A man sold 7% of his farm. What was the size of the farm if he sold 14 acres? (If 7% of the farm is 14 acres, what is 1% of the farm?)

16. If 25% of a farm is 50 acres, how many acres in the farm?

1. Compare 100% with $37\frac{1}{2}\%$.

HINT. $100 = \text{---} \times 12\frac{1}{2}$; $37\frac{1}{2} = \text{---} \times 12\frac{1}{2}$.

2. If $37\frac{1}{2}\%$ of the cost of a house is \$540, what did it cost?

SOLUTION

EXPLANATION. The whole cost is $\frac{8}{3}$ of $37\frac{1}{2}\%$ of it;
 $\frac{8}{3} \times \$540 = \1440 . hence, $\frac{1}{3} \times \$540 =$ the cost.

3. Compare 100% with $16\frac{2}{3}\%$. If a gain of $16\frac{2}{3}\%$ on the cost of a horse is \$18, find the cost.

4. I made $37\frac{1}{2}\%$ on a suit by selling it at \$9 above cost. Find the cost.

5. If 380 acres is 25% of a man's farm, how many acres has he?

6. 40% of the cost of a farm was \$800. Find the total cost.

7. A farmer made \$18 by selling a cow at $33\frac{1}{3}\%$ above cost. What did the cow cost?

8. A farmer lost 320 bushels of beans by a storm. This was 64% of his crop. How many bushels had he? (First find 1% of his crop.)

Find the cost of goods when —

9. The gain = \$8.40, or 7%.

10. The gain = $37\frac{1}{2}\%$ of the cost, or \$7.50.

11. The gain = 30% of the cost, or \$120.

12. I sold a piano for \$48 more than it cost me, thereby making $37\frac{1}{2}\%$. Find the cost.

13. Compare 100% with $62\frac{1}{2}\%$. When $62\frac{1}{2}\%$ of a crop of wheat is 750 bushels, what is the whole crop?

14. $6\frac{1}{4}\%$ of a flock of sheep were sold. If 24 were sold, how many in the flock at first?

15. How many times $6\frac{1}{4}\%$ is $18\frac{3}{4}\%$? Compare 100% with $18\frac{3}{4}\%$. $18\frac{3}{4}\%$ of a crop of apples was 240 bushels. How many bushels in the whole crop?

1. What part of 20 remains after 16 has been taken out? What per cent remains?
2. If I buy for \$12 and sell for \$15, what part of the cost do I gain? What per cent?
3. 20% of \$500 was spent. How much remained?
4. 16¢ is 4% of James's money. How much has he?
5. \$21 is 7% of what?
6. 12 is 0.25 of what number? Read as per cent.
7. Edward spelled 90% of his words correctly. What per cent did he miss? If he missed 12 words, how many did he spell correctly?

Find the selling price when the —

8. Cost is \$40 and the gain is $12\frac{1}{2}\%$.
9. Cost is \$8 and the loss is 25%.
10. Cost is 16¢ and the gain is $37\frac{1}{2}\%$.
11. Cost is \$18 and the loss is $16\frac{2}{3}\%$.
12. If I should take 15% of my money from $\frac{1}{4}$ of my money, the remainder would be \$4. How much have I? ($\frac{1}{4} - 15\% = 10\%$. Why?)
13. I paid \$24 for a watch and sold it at a gain of $12\frac{1}{2}\%$. What did I get for it?
14. I bought a watch for \$24 and sold it for \$27. What per cent did I gain?
15. I gained \$3 on the cost of a watch. This was $12\frac{1}{2}\%$ of the cost. Find the cost.

What per cent of —

16. $\frac{1}{2}$ is $\frac{1}{4}$?
17. $\frac{1}{2}$ is $\frac{3}{4}$?
18. $\frac{1}{2}$ ft. is $\frac{1}{4}$ ft.?
19. $2\frac{1}{2}$ yd. is 5 yd.?

What per cent of —

20. A quart is a pint?
21. A bushel is a gallon?
22. A pound is 2 ounces?
23. A ton is 500 pounds?

1. What is 9% of \$ 840 ? Of 750 lb. ? Of 1640 ft. ?
2. Find 12% of 650 tons ; of 1368 miles ; of 3450 men.
3. How much of \$ 825 have I left after spending 7% of it ?
4. A house costing \$ 6000 sold for 35% less than it cost. Find the selling price.
5. A farmer has 3500 bu. of wheat, and sells 65% of it. How much has he left ?
6. \$ 84 is 12% of what number ? (1% or $\frac{1}{100}$ of the number is what part of \$ 84 ?)
7. 20% of the attendance in a certain school is 640. How many in the class ? (What part of the whole attendance is 20% of it ?)
8. \$ 1.44 is 36% of what ? 256 ft. is 32% of what ?
9. I gained \$ 12, or 8%, when I sold my horse. What did he cost me ? (What is 1% of the cost ?)
10. 16 is what % of 128 ? (What part of 128 is 16 ?)
11. A man lost \$ 17 out of \$ 85. What part of his money did he lose ? What % did he lose ?
12. Flour costs a merchant \$ 6.25 a barrel. What per cent does he gain if he sells it for \$ 6.50 ?
13. I had \$ 85, and lost 20% of it. How many dollars did I lose ?
14. I gain \$ 3.60, or 12%, of the cost of a bicycle. Find the cost.
15. If you pay \$ 30 for an article, and sell it for \$ 33.60, what per cent on the cost do you make ?
16. By selling a horse for \$ 17 less than it cost me I lose 20%. What did I pay for the horse ?

1. What is 50% of 340 ? 25% of \$600 ?
2. 30 is what per cent of 60 ? \$40 is what per cent of \$160 ?
3. 50 is $12\frac{1}{2}\%$ of what number ? 12 is 75% of what ?
4. 4 oz. is what per cent of a pound ? 12 oz. is what per cent of a pound ?
5. 1500 lb. is what per cent of a ton ?
6. What per cent of a yard is 27 inches ?
7. What per cent of a foot is 8 inches ? 9 inches ?
8. A clerk who has \$60 a month receives an increase of $16\frac{2}{3}\%$ in his salary. How much does he then receive ?
9. 120 rods is what per cent of a mile ?
10. A farmer raised 450 bushels of beans, but 150 bushels were damaged by rain. What per cent of his crop was damaged ?
11. My house is insured for \$5000. The insurance costs me 1% every 5 years. What is the average cost per year ?
12. If you miss 5 words out of 80, what per cent do you spell correctly ?
13. A horse that cost \$96 was sold at a gain of $12\frac{1}{2}\%$. Find the selling price.
14. A horse that sold for \$108 cost \$96. What was the gain per cent ?
15. If in an arithmetic test you answer 8 questions out of 12 correctly, what per cent do you have correct ? What per cent are wrong ?
16. Apples that cost \$2 a barrel sold for \$3. How much was gained ? What per cent of the cost was gained ?
17. What is the cost of an article when a 7% gain is \$8.40 ?

1. Bought goods for \$364 and sell them so as to gain 20%. How many dollars do I gain?
2. A house costing \$1785 was sold for \$1530. What was the loss? What per cent of the cost is the loss?
3. Of an estate of 460 acres, 345 acres are given to a wooded park. What per cent of the estate does the park cover?
4. I sold a horse that cost me \$225 for \$270. What per cent did I make on the cost?
5. What per cent of a square foot is 96 square inches?
6. What per cent of a mile is 64 rods?
7. $8\frac{1}{4}\%$ of my rent is \$15. What is my whole rent?
8. I buy a house for \$6000. What per cent shall I gain if I sell it for \$7200?
9. Wood cost me \$7.50 a cord. What shall I ask for it to gain 25%?
10. What per cent shall I lose if I sell it for \$6.00?
11. \$42 is 7% of the cost of a carriage. What shall I gain if I sell it for \$750?
12. A farmer raises 540 bushels of potatoes. He sells 35% of them for 60 cents and the remainder for 54 cents a bushel. What does he get for the whole crop?
13. A merchant's sales for a week were \$2840. If his gain is 26%, what will he gain in one year at this rate?
14. A dealer sold a piano for \$420 that cost him \$360. What per cent of the cost did he gain?
15. $12\frac{1}{2}\%$, or 40, of my flock of sheep are black. How many sheep have I?

1. A speculator bought a house for \$3136 and immediately sold it at an increase of $14\frac{2}{3}\%$. What was his gain?

2. If I paid \$6500 for property and sold it for \$7800, what % did I gain?

3. I bought a farm for \$6000 and spent \$1500 in repairs; for what shall I sell it so as to make 10% of the entire cost?

4. A man earning a salary of \$1750, spends \$1200 for living expenses. What per cent of his salary does he save?

What is:—

5. $62\frac{1}{2}\%$ of 7000?

9. 75% of \$4524.96?

6. $28\frac{4}{5}\%$ of 2555 bbl.?

10. $66\frac{2}{3}\%$ of 944.01 miles?

7. $83\frac{1}{3}\%$ of 506.76 tons?

11. 51% of \$7543.50?

8. $37\frac{1}{2}\%$ of 637.60 lb.?

12. 80% of 617.25?

What per cent of:—

13. 17,500 is 4900?

15. 987 is 227.01?

14. 645 is 412.80?

16. 789.65 is 307.96?

17. 767.14 is what per cent of 3487?

18. 218.71 is what per cent of 2593?

19. 1059.95 is what per cent of 6235?

20. 964 is what per cent of 5784?

21. A man spent $16\frac{2}{3}\%$ or $\frac{1}{3}$ of his salary for board. What was his yearly salary if he paid \$4.50 per week for board?

22. I pay 6% of the cost of property as yearly rent. If my rent is \$300 per year, find the cost of the property.

23. 6.25 is $3\frac{1}{8}\%$ of what?

27. \$165.62 is 13% of \$—?

24. 7.88 is $66\frac{2}{3}\%$ of what?

28. 2271.48 is 23% of what?

25. 260.01 is 27% of —?

29. \$1406.25 is 45% of \$—?

26. \$533.40 is 84% of \$—?

30. 134.64 qt. = 51% of — gal.?

1. I pay \$20 a month for the *use* of another man's house. What is my *rent* for 5 months?

2. I pay a livery-stable keeper 50 cents an hour for the *use* of a horse and buggy. How much *horse-hire* must I pay for 4 hours?

3. Henry Ward pays \$1.00 for the *use* of a bicycle for 5 hours. What is the rate per hour?

4. If I use another's property is it just that I pay him for it?

5. If Mr. Brown should allow me to use money belonging to him, is it just that I should pay him for the use of it?

6. If I should agree to pay him \$6 for the use of \$100 for 1 year, what should I pay him if I use it 2 years? 3 years? 6 months?

7. I can *hire* money by paying 5% of it for using it 1 year. What will the use of \$100 cost me for 1 year? For 2 years? For 6 months?

8. At the same rate, what should I pay for the use of \$300 for 2 yr.?

Money paid for the use of money is interest.

9. What is the *interest* of \$100 for one year, if I pay 7% of it for its use?

10. Find the *interest* of \$200 for 3 yr. at 7%.

The money for the use of which interest is paid is the **principal**.

The rate of interest is the *per cent* of the principal paid for a *year's use* of it.

11. What is meant by the expression 6% interest?

12. What is one year's interest of \$100 at 6%?

13. At 6%, what is the interest of \$200 for 1 year? For 2 years?

14. At 6%, what is the interest of \$300 for 2 years? For 3 years?

15. What is 1 year's interest of \$300 at 5%? At 7%?

16. At 5%, what is the interest of \$500 for 2 years? For 4 years?

1. At 5%, what is the interest of \$ 400 for 1 year? For 6 months?
2. What is the interest of \$ 600 for 8 months at 5%?
3. At 8%, what is a year's interest of \$ 500? 3 years'?
4. At 10%, what is 3 years' interest of \$ 80? 5 years'?

At 6%, what is the interest of:—

- | | |
|-------------------------|-------------------------|
| 5. \$ 500 for 6 mo.? | 8. \$ 250 for 1 year? |
| 6. \$ 300 for 8 mo.? | 9. \$ 150 for 2½ years? |
| 7. \$ 400 for 1½ years? | 10. \$ 350 for 1 year? |

At 5%, what is the interest of:—

- | | |
|-----------------------------|-----------------------------|
| 11. \$ 800 for 1 yr. 6 mo.? | 15. \$ 400 for 2 yr. 3 mo.? |
| 12. \$ 200 for 2 yr. 6 mo.? | 16. \$ 800 for 1 yr. 9 mo.? |
| 13. \$ 300 for 2 yr. 8 mo.? | 17. \$ 700 for 4 years? |
| 14. \$ 600 for 2 yr. 4 mo.? | 18. \$ 90 for 2 yr. 4 mo.? |

At 10%, what is the interest of:—

19. \$ 340 for 1 year? For 2 years? For 3 years?
20. \$ 80 for 6 mo.? For 3 mo.? For 9 mo.?
21. \$ 90 for 4 mo.? For 8 mo.? For 1 year 4 mo.?
22. \$ 450 for 4 mo.? For 1 year 4 mo.? For 1 year 8 mo.?
23. \$ 240 for 1 year? For 1 month? For ½ month?
24. \$ 360 for 1 month? For 15 days? For 10 days?

At 4%, what is the interest of:—

25. \$ 500 for 1 year? For 1½ years? 2½ years?
26. \$ 600 for 1 yr.? For 1 yr. 6 mo.? For 1 yr. 8 mo.?
27. \$ 800 for 6 mo.? For 1 yr. 3 mo.? For ½ yr.?
28. \$ 200 for 2 yr.? For 2 yr. 6 mo.? For 3½ yr.?
29. \$ 500 from Jan. 1 to July 1?
30. \$ 800 for 2 yr. 6 mo.? For 180 da.?

1. What shall I pay for the use of \$84 for 2 yr. 5 mo. at 5%?

WORK

$$\begin{array}{rcl}
 \$84 & = & \text{Principal.} \\
 0.05 & = & \text{Rate for a year.} \\
 \underline{\$4.20} & = & \text{1 year's interest.} \\
 2\frac{5}{12} & = & \text{Time in years.} \\
 12) \underline{\$21.00} & & \\
 \$1.75 & = & \text{Int. for 5 mo.} \\
 8.40 & = & \text{Int. for 2 yr.} \\
 \underline{\$10.15} & = & \text{Int. for 2 yr. 5 mo.} \\
 84. & & \\
 \underline{\$94.15} & = & \text{Amount.}
 \end{array}$$

EXPLANATION. 1 year's interest = 5% of the principal, or \$4.20; $2\frac{5}{12}$ years' interest = $2\frac{5}{12} \times \$4.20$, or \$10.15. The interest added to the principal gives the amount.

REMARK. In finding interest, work with four decimal places when necessary, but give results to the nearest cent.

Find the interest of:—

- | | |
|--------------------------------|----------------------------------|
| 2. \$45 for 2 yr. at 7%. | 6. \$96 for 3 yr. 4 mo. at 7%. |
| 3. \$28 for 3 yr. at 5%. | 7. \$258 for 2 yr. 10 mo. at 5%. |
| 4. \$36 for 1 yr. 6 mo. at 4%. | 8. \$360 for 1 yr. 5 mo. at 4%. |
| 5. \$75 for 2 yr. 3 mo. at 6%. | 9. \$144 for 1 yr. 7 mo. at 10%. |

On the 21st of December, 1903, William Howard, who lives in Springfield, Mass., borrows \$96 of Henry Stevens, promising him in writing to repay the money whenever Mr. Stevens asks for it, together with interest at 7%. The written promise is

A Promissory Note

\$96.

Springfield, Mass., Dec. 21, 1903.

On demand, I promise to pay to the order of

~~~~~ Henry Stevens ~~~~~

~~~~~ Ninety-six ~~~~~ Dollars,

with interest at 7%.

Value received.

William Howard.

1. On May 1, 1904, Frank Adams, who lives in Detroit, Mich., borrows \$150 of George Brown, promising in writing to pay him when he asks for it, with interest at 6%. Write the note.

2. Who holds the note? How long?

3. If Mr. Brown asks for the payment on Sept. 1, 1904, how long has Mr. Adams had the use of the money?

4. How much interest is due Mr. Brown? What is the total amount Mr. Adams has to pay?

The face of the note is the money named in the note.

5. Write a note when the face is \$200; rate, 5%; borrower, John Wilson; lender, W. E. Sims; date, Oct. 15, 1903; place, where you live.

6. What is the total amount due on this note Aug. 15, 1904?

7. Frank Adams allows George Brown the use of \$84 from May 17, 1898, to Dec. 17, 1902, at 4%. What should be paid for the use of the money? Write out a note, payable on demand.

8. Aug. 25, 1899, I hire \$382, agreeing to pay 5% interest. How much will pay both principal and interest Feb. 25, 1904?

9. Write a note for the above, supposing E. L. Harris to have borrowed the money from H. R. Wolf, payable on demand.

10. \$125 is borrowed Dec. 17, 1901, at 6%. What amount will settle the note May 5, 1904?

11. A note is paid Oct. 19, 1902. Its face—the money named in the note—is \$200; the date, May 4, 1900. What is due?

12. Write a demand note when the face is \$300; rate, 6%; borrower, yourself; lender, E. R. Smith; date, when you write it; place, where you live.

192 TO FIND THE TIME FROM ONE DATE TO ANOTHER *Written*

The year is divided into 12 calendar months as follows:—

| | | | | |
|------------------|----------------|------------|----------|----------|
| January, 1st mo. | 31 days. | July, | 7th mo. | 31 days. |
| February, 2d mo. | 28 or 29 days. | August, | 8th mo. | 31 days. |
| March, 3d mo. | 31 days. | September, | 9th mo. | 30 days. |
| April, 4th mo. | 30 days. | October, | 10th mo. | 31 days. |
| May, 5th mo. | 31 days. | November, | 11th mo. | 30 days. |
| June, 6th mo. | 30 days. | December, | 12th mo. | 31 days. |

When the number of a year is divisible by 4, the year is a leap year. Centennial years are exceptions unless their number is divisible by 400.

In a leap year February has 29 days.

In most business operations 30 days are considered a month.

1. In which of the following-named years will February have 29 days? 1894; 1896; 1900; 1904; 2000.

2. How many years, months, and days from July 14, 1898, to May 10, 1904?

| | |
|--|--|
| <p>WORK</p> <p>1904 yr. 5 mo. 10 da.</p> <p>1898 yr. 7 mo. 14 da.</p> <hr style="width: 20%; margin-left: 0;"/> <p>5 yr. 9 mo. 26 da.</p> | <p>EXPLANATION. We write the 10th day of the 5th month of 1904 as the minuend, and the 14th day of the 7th month of 1898 as the subtrahend. Putting 1 of the 5 mo., or 30 da., with the 10 da., we have 40 da.; 14 da. from 40 da. = 26 da. Putting 1 yr., or 12 mo., with the 4 mo. (5 mo. - 1 mo. = 4 mo.), we have 16 mo.; 7 mo. from 16 mo. = 9 mo.; 1898 yr. from 1903 yr. = 5 yr.</p> |
|--|--|

Find the time in years, months, and days from:—

3. Aug. 10, 1903, to Dec. 15, 1905.

4. May 5, 1904, to July 8, 1906.

5. Jan. 26, 1902, to Feb. 6, 1907.

6. Sept. 28, 1903, to May 19, 1908.

7. March 1, 1905, to May 14, 1907.

8. Dec. 25, 1904, to July 4, 1905.

9. Nov. 25, 1906, to June 7, 1908.

1. What is the interest of \$ 1 for 1 year at 6%?
2. The interest of \$ 1 for 2 yr. at 6% = $\text{---} \times 6\%$, or --- .
3. At the same rate, what is the interest of \$ 1 for 3 yr.? For 4 yr.? For 5 yr.?
4. Since the interest of \$ 1 at 6% is 6¢ for 1 year, what is the interest per year of \$ 5 at the same rate?
5. What is the interest of \$ 1 for 6 mo. at this rate?
6. What is the interest of \$ 5 for 6 mo. at 6%?
7. What is the interest of \$ 10 for 1 yr. 6 mo.?
8. What is the interest of \$ 50 at 6% for 10 mo.?

The interest of \$ 1 at 6% is 6¢ for every year and $\frac{1}{2}$ ¢ for every month.

9. What is the interest of \$ 200 for 2 yr. 9 mo.?

NOTE. When no rate of interest is mentioned in connection with exercises in this book, 6% is to be understood.

WORK

$$\begin{array}{l} \text{Int. of \$ 1 for } \left\{ \begin{array}{l} 2 \text{ yr.} = 2 \times 6\% = \$ 0.12 \\ 9 \text{ mo.} = 9 \times \frac{1}{2}\% = \underline{0.045} \\ 2 \text{ yr. 9 mo.} = \underline{\underline{\$ 0.165}} \end{array} \right. \\ \text{Int. of \$ 200 is } 200 \times \text{int. of \$ 1} = \underline{\underline{\$ 33.000}} \end{array}$$

Find the interest of:—

10. \$ 360 for 2 yr. 1 mo.
11. \$ 22.50 for 3 yr. 3 mo.
12. \$ 98 for 4 yr. 5 mo.
13. \$ 287 for 3 yr. 7 mo.
14. \$ 64.75 for 5 yr. 9 mo.

Find the amount of:—

15. \$ 495 for 7 yr. 11 mo.
16. \$ 510 for 4 yr. 8 mo.
17. \$ 37.50 for 1 yr. 5 mo.
18. \$ 62.80 for 27 mo.
19. \$ 975 for 21 mo.

1. At 6%, what is the interest of \$1 for 1 year? For 1 month? $\frac{1}{2}\%$ = — mills.

NOTE. In computing interest, 30 days = 1 month; 360 days = 1 year.

2. Since the interest of \$1 for 1 month is 5 mills, what will the interest for 1 day be?

3. Since the interest of \$1 for 1 day at 6% is $\frac{1}{6}$ of a mill, or \$0.000 $\frac{1}{6}$, what is the interest for 6 days? 12 days?

4. What is the interest of \$1 for 18 days? For 24 days?

At 6% the interest of \$1 for 1 day is $\frac{1}{6}$ of a mill, or \$0.000 $\frac{1}{6}$.

Written

5. Find the interest of \$300 for 2 yr. 11 mo. 21 da.

| | | |
|---------------------------------------|---|--|
| WORK. | { | 2 yr. = $2 \times 6\%$ = \$0.12 |
| Int. of \$1 for | | 11 mo. = $11 \times \frac{1}{2}\%$ = 0.055 |
| | | 21 da. = $21 \times \frac{1}{6}\text{m.}$ = 0.0035 |
| Int. of \$1 for 2 yr. 11 mo. 21 da. = | | \$0.1785 |
| | | <u>300</u> |
| | | \$53.5500 |

Find the interest of: —

6. \$5 for 1 yr. 10 mo. 12 da. 13. \$42 for 1 yr. 7 mo. 12 da.

7. \$8 for 2 yr. 8 mo. 24 da. 14. \$72 for 1 yr. 8 mo. 3 da.

8. \$9 for 3 yr. 5 mo. 15 da. 15. \$96 for 2 yr. 1 mo. 27 da.

9. \$12 for 2 yr. 7 mo. 15 da. 16. \$108 for 3 yr. 3 mo. 9 da.

10. \$10 for 1 yr. 6 mo. 15 da. 17. \$14.40 for 7 mo. 21 da.

11. \$20 for 3 yr. 9 mo. 18 da. 18. \$28.44 for 1 yr. 27 da.

12. \$30 for 4 yr. 11 mo. 24 da. 19. \$504 for 63 da.

20. What shall I pay for the use of \$350 at 6%, from July 6, 1902, to Sept. 27, 1904?

21. Find the amount of \$500 at 6%, borrowed May 10, 1903, and repaid Sept. 7, 1904.

1. The interest of \$400 at 6% for 1 year is what?
2. What part of 6% is 1%? Of 6% is 2%? Of 6% is $1\frac{1}{2}\%$? Of 6% is 3%? Of 6% is 4%? Of 6% is 5%?
3. If the interest at 6% is \$24, what would it be at 1%? At $1\frac{1}{2}\%$? At 2%? At 3%?
4. The interest of a sum of money at 6% was \$30. What would it have been at 1%? At 2%? At 3%? At 4%?
5. If I should add 2% interest to 6% interest, I should have interest at what %?
6. If the interest at 6% is \$24, what is the interest at 8%?
7. 5% is how many % less than 6%? 1% is what part of 6%? Then 5% is what part of 6% less than 6%?
8. If the interest at 6% is \$12, what is the interest of the same amount and same time at 5%? SUGGESTION. \$12 less $\frac{1}{6}$ of \$12 = \$10.
9. What is the interest of \$100 for 2 yr. at 6%? At 4%? At 8%? At 7%?
- SUGGESTION. $7\% = 6\% + 1\%$. Interest at 6% = \$12; at 1% = \$2; at 7% = \$14.
10. Find the interest on \$100 for 2 yr. 8 mo. at 5%.
- SUGGESTION. First find the interest at 6%.
11. Find the interest on \$25 for 3 yr. 4 mo. at 7%.

Observe that after we have found the interest at 6%, we may find the interest at any other rate by adding or subtracting the proper part of 6% interest.

Remember that

| | | |
|---------------------------------------|---|----------------------|
| $1\% = \frac{1}{6}$ of 6%. | $4\% = 6\% - 2\%$. | $8\% = 6\% + 2\%$. |
| $1\frac{1}{2}\% = \frac{1}{4}$ of 6%. | $4\frac{1}{2}\% = 6\% - 1\frac{1}{2}\%$. | $9\% = 6\% + 3\%$. |
| $2\% = \frac{1}{3}$ of 6%. | $5\% = 6\% - 1\%$. | $10\% = 6\% + 4\%$. |
| $3\% = \frac{1}{2}$ of 6%. | $7\% = 6\% + 1\%$. | $11\% = 6\% + 5\%$. |

1. Find the interest of \$70 for 2 yr. 9 mo. 12 da. at 4%.

WORK

| | | |
|-----------------------|-----------------|-----------|
| At 6% int. of \$1 for | \$0.167 | |
| 2 yr. = \$0.12 | <u>70</u> | |
| 9 mo. = 0.045 | 3)\$11.690 | = 6% int. |
| 12 da. = 0.002 | 3.8966+ | = 2% int. |
| <u>\$0.167</u> | <u>\$7.7934</u> | = 4% int. |

2. What is the interest of \$8 for 3 yr. 1 mo. 18 da. at 7½%?

WORK

| | | |
|-----------------------|----------------|------------|
| At 6% int. of \$1 for | \$0.188 | |
| 3 yr. = \$0.18 | <u>8</u> | |
| 1 mo. = 0.005 | 4)\$1.504 | = 6 % int. |
| 18 da. = 0.003 | 0.376 | = 1½% int. |
| <u>\$0.188</u> | <u>\$1.880</u> | = 7½% int. |

Find the interest under the following conditions:—

| Principal | Time | Rate | Principal | Time | Rate |
|-----------|--------------------|------|--------------|--------------|------|
| 3. \$25 | 1 yr. 3 mo. 7 da. | 5. | 11. \$48.60 | 2 mo. 17 da. | 10. |
| 4. \$48 | 2 yr. 4 mo. 12 da. | 7. | 12. \$74.96 | 108 da. | 11. |
| 5. \$75 | 8 mo. 15 da. | 4. | 13. \$85.14 | 1 yr. 19 da. | 8. |
| 6. \$84 | 3 yr. 26 da. | 8. | 14. \$73.62 | 6 mo. 5 da. | 7. |
| 7. \$108 | 4 mo. 19 da. | 9. | 15. \$84.06 | 84 da. | 4. |
| 8. \$270 | 4 yr. 3 mo. | 4½. | 16. \$178.12 | 109 da. | 7½. |
| 9. \$195 | 93 da. | 3. | 17. \$242.18 | 26 mo. | 9. |
| 10. \$277 | 1 yr. 8 da. | 2. | 18. \$647.91 | 117 da. | 5. |

Find the interest under the following conditions:—

19. \$150 borrowed Aug. 10, 1903, paid Dec. 4, 1904, interest 6%.
20. \$340, at 7%, from Jan. 3, 1903, to Aug. 21, 1904.
21. \$640 at 5%, from April 12, 1903, to Jan. 1, 1904.
22. \$780 at 8%, from March 4, 1903, to Dec. 16, 1904.
23. What is due Jan. 3, 1905, on a note for \$500, dated July 8, 1903; interest 7%?

Such numbers as 3 ft., 6 lb., 8 gal., etc., are called **simple numbers**, for they are expressed in terms of a single unit of measure.

Numbers like 2 lb. 4 oz., made up of two or more numbers expressed in units of the same general kind, are called **compound numbers**.

1. 3 ft. 9 in. are how many inches?
2. 1 yd. 2 ft. 7 in. are how many inches?
3. 2 lb. 9 oz. are how many ounces?
4. 3 bu. 6 qt. are how many quarts?
5. In 1 bu. 3 pk. how many pecks?
6. In 87 in. how many yards and inches? How many feet and inches? How many yards, feet, and inches?
7. In 60 oz. how many pounds and ounces?
8. How many minutes in 2 hr. 45 min.?
9. Add 3 ft. 4 in. and 2 ft. 8 in.
10. Add 2 ft. 7 in. and 5 ft. 11 in.
11. Take 1 yr. 9 mo. from 5 yr. 6 mo.
12. In $\frac{4}{9}$ of a yard how many feet and inches?
13. How many feet and inches in a rod? In $\frac{1}{2}$ a rod?
14. Find the perimeter of a square 2 ft. 4 in. long.
15. What will 2 lb. 5 oz. of butter cost at 32¢ a pound?
16. What will 27 ft. of picture cord cost at 12¢ a yard?
17. How many days from May 10 to June 26?
18. What part of a minute is 48 seconds?
19. How long is the day when the sun rises at 7.15 and sets at 4.20?
20. How many square feet in 4 sq. yd. 7 sq. ft.?

1. Change 5 yd. 2 ft. 8 in. to inches.

PRACTICAL CALCULATION

| | | |
|---------------------------------------|-------------------|-------------------------------------|
| ANALYSIS | 5 | |
| 1 yd. = 3 ft. | $\times 3$ | |
| 5 yd. = 5×3 ft. or 15 ft. | $\frac{15}{15}$ | = the number of feet in 5 yd. |
| 15 ft. + 2 ft. = 17 ft. | $+ 2$ | |
| 1 ft. = 12 in. | $\frac{17}{17}$ | = the number of feet in 5 yd. 2 ft. |
| 17 ft. = 17×12 in. = 204 in. | $\times 12$ | |
| 204 in. + 8 in. = 212 in. | $\frac{204}{204}$ | = the number of inches in 17 ft. |
| | $+ 8$ | [8 in. |
| | $\frac{212}{212}$ | = the number of inches in 17 ft. |

2. Change 6 lb. 10 oz. to ounces.
3. Change 5 gal. 3 qt. 1 pt. to pints.
4. Change 13 hr. 24 min. to seconds.
5. Change 3 sq. ft. 84 sq. in. to square inches.
6. Change 6 hr. 54 min. 20 sec. to seconds.
7. Change 32 T. 350 lb. to pounds.
8. Change 5 cu. ft. 128 cu. in. to cubic inches.
9. Change 115 in. to a larger unit.

PRACTICAL CALCULATION

ANALYSIS

1 in. = $\frac{1}{12}$ ft.

115 in. = $115 \times \frac{1}{12}$ ft. or $9\frac{7}{12}$ ft.,

1 ft. = $\frac{1}{3}$ yd. or 9 ft. 7 in.

9 ft. = $9 \times \frac{1}{3}$ yd. or 3 yd., then

115 in. = 3 yd. 7 in.

$$\begin{array}{r} 12 \overline{)115} \\ 3 \overline{)9} \quad 7 \\ \underline{3} \end{array}$$

EXPLANATION. 115 in. \div 12 in. = 9 times and a remainder of 7 in. 9 is the number of 12 in., or the number of feet. 9 ft. \div 3 ft. = 3 times, which is the number of 3 ft. (or yards) in 9 ft.

10. Change 248 in. to larger units.
11. Change 5460 sec. to hours, minutes, and seconds.
12. Change 54 pt. to larger units.
13. Change 463 oz. to pounds.
14. Change 963 sq. in. to square feet.

1. Add:—

1 ft. 8 in.

2 ft. 3 in.

5 ft. 10 in.

9 ft. 9 in.

EXPLANATION. The sum of the first column is 21 in., or 1 ft. and 9 in. The sum of the second column is 8 ft.; 8 ft. + 1 ft. = 9 ft.

2. Add 3 gal. 2 qt., 5 gal. 3 qt., 7 gal. 1 qt.

3. Add 7 bu. 3 pk., 10 bu. 2 pk., 13 bu. 3 pk., 6 bu. 1 pk.

4. Add 3 yd. 2 ft. 10 in., 7 yd. 2 ft. 3 in., 10 yd. 1 ft. 9 in.

5. From 6 ft. 2 in. subtract 3 ft. 9 in.

6 ft. 2 in.

3 ft. 9 in.

2 ft. 5 in.

EXPLANATION. Since 9 in. cannot be taken from 2 in., 1 ft. is taken from 6 ft. and put with 2 in. making 14 in. Now 9 in. from 14 in. leaves 5 in. 5 ft. — 3 ft. = 2 ft.

6. From 6 gal. 1 qt. 1 pt. take 3 gal. 2 qt. 1 pt.

7. Find the difference between 14 hr. 20 min. 13 sec. and 10 hr. 48 min. 20 sec.

8. Find the difference between 6 yd. 2 ft. 8 in. and 4 yd. 2 ft. 11 in.

9. 3 gal. 2 qt.

× 5

17 gal. 2 qt.

10. $4\overline{)7}$ yd. 2 ft. 8 in.

1 yd. 2 ft. 11 in.

11. Study Exercise 9 and discover how the multiplication was performed.

12. Study Exercise 10 and discover how the division was performed.

13. Divide 3 ft. 8 in. by 6.

14. Multiply 3 lb. 6 oz. by 9.

15. Multiply 3 yd. 2 ft. 10 in. by 7.

16. Divide 12 lb. 10 oz. by 6.

17. Divide 5 yd. 2 ft. 10 in. by 1 ft. 6 in.

HINT. Change both to inches.

1. Compare an inch with a foot; a foot with a yard.
2. Compare a square inch with a square foot; a square foot with a square yard.
3. Short distances are measured in inches, —, or —. Long distances are measured in *rods* and *miles*.

$$5\frac{1}{2} \text{ yards or } 16\frac{1}{2} \text{ feet} = 1 \text{ rod (rd.)}$$

$$320 \text{ rods} = 1 \text{ mile (mi.)}$$

4. How many feet in a mile? $320 \times 16\frac{1}{2} \text{ ft.} = \text{— ft.}$
5. How many rods in 2 miles? In $1\frac{1}{2}$ miles?
6. How many rods in $\frac{1}{2}$ mile? In $\frac{1}{4}$ mile? In $\frac{1}{8}$ mile?
7. What part of a mile in 40 rd.? In 80 rd.? In 160 rd.?
8. What per cent of a mile is 160 rd.? Is 80 rd.?
9. How many rods in $37\frac{1}{2}\%$ of a mile? In $62\frac{1}{2}\%$?
10. I live $87\frac{1}{2}\%$ of a mile from school. How many rods do I have to walk in going to school and returning?
11. There are 5280 feet in a mile. How many feet in 20% of a mile? In 75% of a mile?
12. 5280 ft. is what part of a mile?
13. What part of a mile is 5280 ft.? Is 5280 ft.?
14. How many inches in a rod?
15. 19.8 inches equals what part of a rod?
16. 99 inches is what per cent of a rod?
17. Find the number of inches in a mile. In $62\frac{1}{2}\%$ of a mile.
18. In $13\frac{1}{2}$ miles, how many feet?
19. How many feet and inches in 75 rd.?

(See page 17.)

1. Draw a square inch. Describe a square inch.
 2. Draw a rectangle 2 inches long and 1 inch wide. What is its area? Describe a rectangle. Is a square a rectangle?
 3. Draw a 2-inch square. How many square inches in a 2-inch square?
 4. Compare a 2-inch square with 2 square inches, in respect to both their areas and perimeters.
 5. Draw an oblong 1 inch by 3 inches. Draw a 3-inch square. Compare them as in Example 4.
 6. Draw a 2-inch square and a 4-inch square. Compare their lengths, their perimeters, and their areas
 7. Draw a 12-inch square. Draw a rectangle 1 inch by 12 inches. Compare their areas.
 8. How many square inches in a rectangle 1 inch by 12 inches?
 9. How many square inches in a 12-inch square?
- A 12-inch square is called a **square foot**.

A square foot = — square inches.

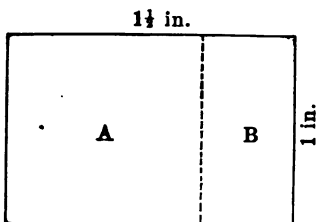
10. Draw on the blackboard a square a yard long. What is it called?
11. Separate it into square feet. How many square feet in a square yard?

A square yard = — square feet.

Draw diagrams, and find areas of rectangles that are: —

12. 12 feet long and 8 feet wide. (Draw to the scale of $\frac{1}{12}$.)
13. 16 feet long and 4 feet wide.
14. 8 yards long and 6 yards wide.

1. Draw a rectangle 1 inch wide and $1\frac{1}{2}$ inches long.



Draw a line cutting off 1 square inch.

What kind of a figure remains?

Call the square *A* and the oblong *B*.

Compare *A* and *B*. What is the area of *B*?

2. Draw a rectangle 2 inches wide and $2\frac{1}{2}$ inches long. What is the area? How many square inches will a strip 1 inch wide and $2\frac{1}{2}$ inches long contain? How many such strips in the rectangle?

3. Draw a square 1 inch long. Divide it into two equal oblongs. Divide one oblong into two equal squares.

4. What are the dimensions of the oblong? Its area?

5. What is the length of one of the small squares? The area of each?

6. The area of an oblong 1 inch by $\frac{1}{2}$ inch = ——. That of a square $\frac{1}{2}$ inch long = ——.

7. Draw a rectangle $2\frac{1}{2}$ inches wide and $3\frac{1}{2}$ inches long. Divide into strips 1 inch wide and $3\frac{1}{2}$ inches long. How many such strips? What is the area of the remaining strip? How does it compare in area with the other two strips?

8. What is the area of an oblong 1 inch by $3\frac{1}{2}$ inches? What is the area of $2\frac{1}{2}$ such oblongs?

9. On your playground draw a square a rod long. Divide it into oblongs a yard wide. What small oblong do you have left?

10. Draw on paper a plot of a square rod, using an inch to represent a yard. What scale is this?

11. How many square yards in an oblong 1 yard wide and $5\frac{1}{2}$ yards long? How many such oblongs? How many square yards in the square rod?

12. Divide the square rod into oblongs 1 foot wide. Find the number of square feet in a square rod.

$$\begin{array}{l} \text{— square yards} \\ \text{or — square feet} \end{array} \left. \vphantom{\begin{array}{l} \text{— square yards} \\ \text{or — square feet} \end{array}} \right\} = 1 \text{ square rod.}$$

A square rod is used in measuring small pieces of land.

For measuring larger pieces of land we use a larger unit, the *acre*, which contains 160 square rods.

13. Measure in the playground, or in some field, a rectangle 10 rd. wide and 16 rd. long. What is its area? This is an acre.

14. $8 \times ? = 160$. Measure off on your playground a rectangle 8 rd. by 20 rd., or an acre.

15. How wide must a rectangular field 40 rd. long be to contain 1 acre? To contain 3 acres? 5 acres? 10 acres?

16. Farmers often divide their farms into 10 acre fields 40 rd. square. For convenience in plowing they divide the field into oblongs 2 rd. or 4 rd. wide, called *lands*. What part of an acre in a 2-rod land? A farmer plows four 2-rod lands in a day. How many acres does he plow?

17. How many acres in a field 80 rd. long and 10 rd. wide?

Learn:—

$$\begin{array}{l} 144 \text{ square inches} = 1 \text{ square foot.} \\ 9 \text{ square feet} = 1 \text{ square yard.} \\ 30\frac{1}{4} \text{ square yards} \\ 272\frac{1}{4} \text{ square feet} \end{array} \left. \vphantom{\begin{array}{l} 30\frac{1}{4} \text{ square yards} \\ 272\frac{1}{4} \text{ square feet} \end{array}} \right\} = 1 \text{ square rod.}$$

$$160 \text{ square rods} = 1 \text{ acre.}$$

18. 2000 sq. in. = — sq. ft.

22. 4 A. = — sq. ft.

19. $3\frac{3}{4}$ sq. ft. = — sq. in.

23. 7623 sq. ft. = — sq. rd.

20. 726 sq. yd. = — sq. rd.

24. 10,000 sq. rd. = — A.

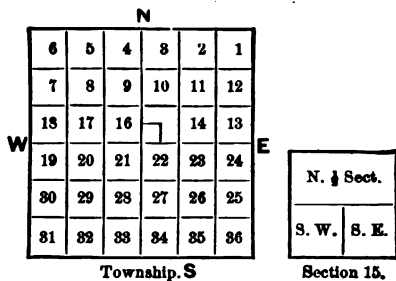
21. 160 sq. rd. = — sq. ft.

25. 1 A. = — sq. rd.

1. How many square feet in a plot of ground 30 ft. by 120 ft. ?
 2. If a plot of ground 40 ft. by 120 ft. is worth \$800, what is a plot 40 ft. by 180 ft. worth at the same rate ?
- HINT. How much larger is the second plot? How many times as large as the first ?
3. The dimensions of a room are, width 15 ft., length 18 ft., height 9 ft. Not deducting for doors, windows, etc., how many square yards of plastering on the walls and ceiling ?
 4. In a garden 120 ft. by 50 ft. is a bed of peas 20 ft. by 30 ft. What ratio of the whole garden is planted in peas? What % ?
 5. In a lot 72 ft. by 150 ft. is a house whose foundation is 30 ft. by 42 ft. and a barn 20 ft. by 30 ft. How many square feet of lawn, not deducting for walks? Make a diagram ?
 6. It takes 9 shingles to cover a square foot of roof. How many shingles will be required to roof a barn whose rafters on each side are 16 ft. long, the length of the roof being 40 ft. ?
 7. Shingles are put up 250 in a bunch. How many bunches will it be necessary to buy? (Parts of a bunch are not sold.)
 8. What will the shingles cost at \$4.25 per 1000 ?
 9. How many square rods of flagstone are required for a walk 72 ft. long and $4\frac{1}{2}$ ft. wide ?
 10. What will the walk cost at \$1.75 per square yard ?
 11. How many bricks 4 in. by 8 in. will pave the walk described in Exercise 9 ?
- HINT. How many bricks will it take to pave 1 square foot ?
12. On a lot 60 ft. wide and 120 ft. long, I have a house 30 ft. wide and 40 ft. long and a garden 40 ft. square. How many square feet of lawn remain ?

Large tracts of land are measured by the **section**, which is a *square mile*.

1. There are 320 rods in a mile. How many acres in a section?
2. A man owns a quarter-section of land. How many acres has he? How many miles of fence will inclose it if it is square? Draw a diagram.
3. A owns a tract of land 80 rd. wide and 160 rd. long. What part of a section does he own?
4. What is his land worth at \$40 per acre?
5. A farm 80 rd. square is divided into 4 square fields. Find the dimensions and area of each field.
6. Make a diagram of the farm described in Exercise 5 and find the cost of fencing into 4 fields, at 60¢ a rod.
7. If a farmer gets 900 bushels of wheat from a field 80 rd. by 40 rd., what is the yield per acre?
8. I paid at the rate of \$6000 an acre for a city lot 66 ft. by 165 ft. What did it cost me?
9. I paid \$800 for a city lot 33 ft. by 66 ft. What is that per acre?
10. What is the area of $\frac{1}{2}$ mile of street 4 rd. wide?
11. If a city block is 660 ft. long and $\frac{3}{4}$ as wide, how many acres does it contain?
12. I bought a square lot of land 3000 feet long. I laid out a 40-ft. street through the middle of it in each direction. Draw a diagram and find the area of each of the 4 lots that remained.
13. Estimate the cost of the blackboards in your schoolroom at 75¢ a square yard.



Many of the central and western states are divided into **townships** 36 miles square.

Each township is divided into *sections*, and each section is numbered as in the diagram above.

1. How many acres in a section? In a township?
2. A man's farm is described as the southwest quarter of section 15. Locate his land in the figure. How many acres does it contain?
3. How many rods around his farm?
4. What is the north half of the northeast quarter of section 26 worth at \$45 per acre? Locate it.
5. A $\frac{1}{2}$ mile square is what part of a section? How many acres does it contain?
6. A man owns 40 acres. What part of a section does he own?
7. If his farm is square, what part of a mile in length is it? How far around it?
8. What will it cost to fence a half-section at 75¢ a rod?
9. A farmer owning 4 sections raises 20 bu. of wheat to the acre and sells it at 60¢ a bushel. What does he receive for the crop?
10. Bought a half-section of land at \$24 an acre and sold it at 10¢ a square foot. What were the profits?

This diagram represents a plot of land.

1. Divide the field into three rectangles. Can you do this in more than one way?

2. What is the area of each rectangle? What then is the area of the whole plot?

3. What is the largest rectangular field you can cut from this by two straight lines? How many square rods in it? What is its perimeter?

4. What is the smallest rectangle that can be cut from this figure by one straight line? Its area?

5. The lower figure represents the outline of a cellar. Copy and divide into four rectangles. In how many ways can this be done?

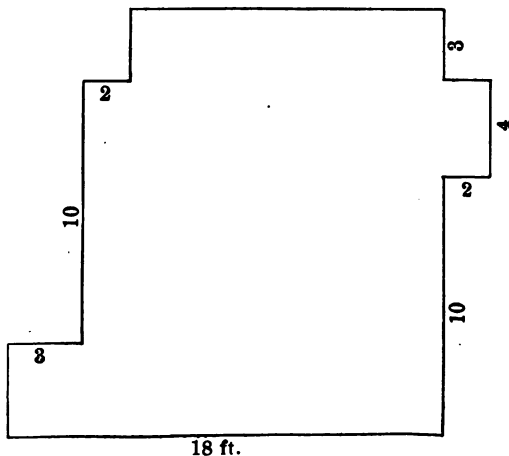
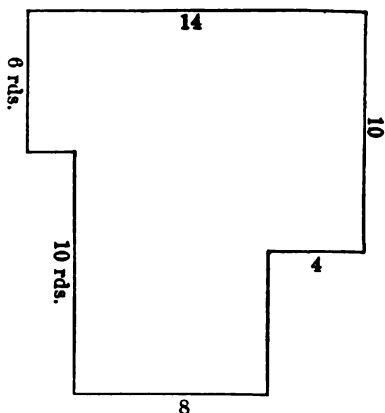
6. From the given dimensions find those of each rectangle.

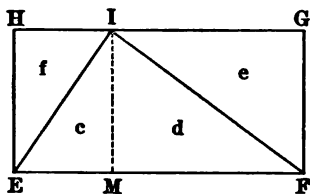
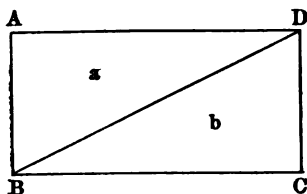
7. Find the perimeter represented.

8. Find the area of each rectangle.

9. What is the whole area of the bottom of the cellar?

10. What will it cost to cement the bottom at 27¢ a square foot?





1. The line BD , called the **diagonal**, divides the rectangle $ABCD$ into how many parts?

2. How many sides has each figure? How many angles? Which one is a square angle, or **right angle**?

A surface bounded by three straight lines is called a **Triangle**. When one angle of the triangle is a **right angle**, the triangle is called a **right triangle**.

3. Compare the right triangles a and b . What part of the rectangle is a ? Is b ?

4. If the rectangle represents a surface 8 inches long and 4 inches wide, what is its area? What is the area of each of the triangles? Make the rectangle on cardboard, cut into two triangles and *prove* it

5. In the rectangle $EFGH$ what kind of angles are made by the lines EF and IM ?

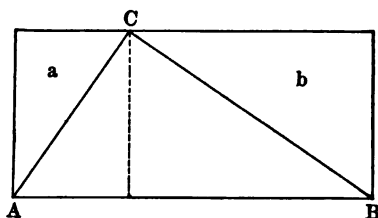
A line drawn from any corner of a triangle to the opposite side so as to make right angles with the side, is called the **altitude** of the triangle, and the side to which it is drawn is called the **base**. A corner of the triangle is called a **vertex**.

6. In triangle EFI name the vertices. The base. The altitude.

7. Name the two rectangles into which IM divides the rectangle.

8. If AB is 6 yards and BC is 72 feet, what is the area of the rectangle?

9. What is the perimeter of the rectangle if BC measures 27 rods?



1. How does the altitude of the triangle compare with the width of the rectangle?

2. How does the area of a triangle compare with the area of a rectangle, one of whose sides is equal to the base and the other to the altitude of the triangle?

3. Prove your answer by making a rectangle from cardboard and then cutting off parts *a* and *b* and so placing them as to make another triangle that can just be covered by triangle *ABC*.

Principle. *The area of a triangle is equal to one half that of a rectangle having the same dimensions as the base and altitude of the triangle.*

4. What is the area of a rectangle whose dimensions are 8 inches and 5 inches?

5. What is the area of a triangle whose base is 8 inches and altitude 5 inches?

6. Find the area of a triangle whose base is 10 inches and altitude 7 inches.

7. Find the area of a triangle whose base is 12 inches and altitude 8 inches.

Find the areas of triangles:—

- | | |
|----------------------------------|----------------------------------|
| 8. Base 20 rd., altitude 8 rd. | 11. Base 12 in., altitude 8 in. |
| 9. Base 14 in., altitude 10 in. | 12. Base 16 ft., altitude 5 ft. |
| 10. Base 18 in., altitude 10 in. | 13. Base 20 ft., altitude 12 ft. |

1. What is a square foot? What is a cubic foot?

A board-foot is a square piece of board *a foot long, a foot wide, and an inch thick.*

2. How many such pieces of board piled together would make a foot-cube?

Boards, plank, joists, beams, and squared timber are measured in board-feet.

3. If there were no waste in sawing, how many boards 1 ft. square could be cut from a board 8 ft. long and 12 in. wide?

4. How many board-feet in a board 9 in. wide and 16 ft. long?

5. Suppose it were 3 in. thick. What would it contain?

NOTE. In finding the contents of a piece of lumber we do not consider the thickness unless it is *more* than an inch.

Find the contents in board-feet of:—

6. A plank 10 ft. long, 6 in. wide, 2 in. thick.
7. A joist 15 ft. long, 4 in. wide, 3 in. thick,—a “3 × 4 joist.”
8. A board 18 ft. long, 18 in. wide, 1½ in. thick.
9. A 3 × 5 joist 20 ft. in length.
10. A beam 18 ft. long, 8 in. wide, 6 in. thick.

Lumber is generally sold for so much per thousand (M) board-feet.

Find what must be paid for:—

11. 3000 ft. of spruce @ \$16. 14. 800 ft. of walnut @ \$60.
12. 2½ M. white pine @ \$17. 15. 750 ft. of whitewood @ \$38.
13. 4500 ft. hard pine @ \$42. 16. 1600 ft. of cherry @ \$80.
17. What will hard pine flooring for a room 16 ft. long and 12 ft. wide cost at \$35 per thousand, not allowing anything for waste?

1. The diagram represents the gable end of a barn. What are the dimensions of the rectangular part of this end?

2. Give the base and altitude of the triangular part, the *gable*. 8 ft. is the height above the *eaves*.

3. What is the area of the part represented in the figure?

4. How many feet of lumber will it take to cover it? What will this cost at \$20 per M.?

5. If the barn is 36 ft. long, what are the dimensions of each side? The area of each side?

6. What is the total area of both sides and both ends?

7. What will the lumber cost at \$17.50 per M. for both sides and ends without gables?

8. A barn is 30 feet by 50 feet. It is 16 feet to the eaves and the gable is 10 feet high. Draw a diagram of an end and a side.

9. How much siding will it take? What will it cost at \$18.25 per M.?

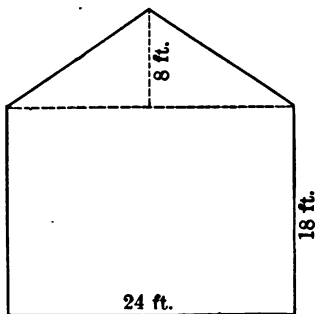
10. How many feet of lumber will it take to build a 6-board fence around a lot 6 rods by 8 rods, the boards being 6 inches wide?

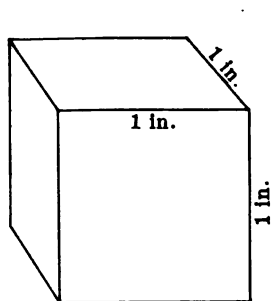
11. What will the boards cost at \$22 per M.?

12. Find the cost of a beam 8 inches by 10 inches and 24 feet long, at \$30 per M.

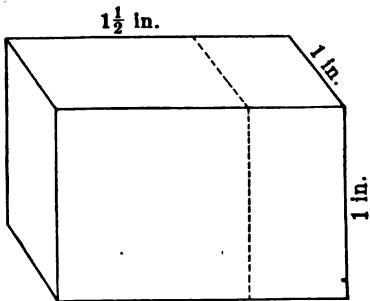
13. The floor of your schoolroom may be 28 ft. by 32 ft. What will the flooring cost at \$60 per M.?

14. A walk across the park is made of 2-inch planks. How many board feet will be required if the walk is 200 feet long and 6 feet wide?





A



B

1. We measure distances in inches, —, —, or —.
2. We measure surfaces in square inches, —, —, or —.
3. Lines have *one* dimension only: namely, —
4. Surfaces have *two* dimensions: namely, — and —.
5. Objects that occupy space and have weight are called **Solids**. Solids have *three* dimensions: namely, *length*, *breadth*, and *thickness*. Name some solids.
6. In what units would we measure the edges of the solids here shown? The surfaces?
7. How many surfaces has each of these solids?
8. What is the shape of each surface in the solid at the left? What is such a solid called?
9. What is the shape of each surface in the solid at the right? A solid bounded by six rectangles is a **rectangular solid**.
10. Are squares rectangles? Are these rectangular solids?
11. How many square surfaces has solid B? A *rectangular solid* with two square surfaces is a **square prism**.
12. Compare the size of B with that of A. If A is a cubic inch, what is B?

1. A square prism 3 inches long, 1 inch wide, and 1 inch thick can be cut into how many cubic inches?

2. Two such prisms put side by side will make a rectangular solid of what dimensions? How many cubic inches will this solid contain?

3. With 1-inch cubes make a rectangular solid 4 inches long, 3 inches wide, and 2 inches thick. How many did it take?

4. We speak of the measure of a line as its —, of a surface as its area, and of a *solid* as its *contents* in cubic inches, cubic feet, or cubic yards.

5. How many square prisms 1 in. by 1 in. by 3 in. can be cut from a rectangular solid 2 in. by 3 in. by 3 in.?

6. Find the contents of a rectangular solid 2 in. by 2 in. by 5 in.

SUGGESTION. The solid may be divided into 2 sections, 2 in. by 5 in. and 1 in. thick. Each section can be divided into 2 square prisms 1 in. by 1 in. by 5 in., each containing 5 cu. in., hence the volume is $2 \times 2 \times 5$ cu. in.

7. Draw a diagram and find the volume of a square prism 3 inches by 3 inches by 4 inches.

8. Find the contents of a block 2 inches by 3 inches by 5 inches. Draw a figure.

Observe that in finding the contents of a rectangular prism we think of the number of sections one unit thick, and the number of square prisms in each section.

9. Find the number of cubic inches in a rectangular block 2 inches by 2 inches by $4\frac{1}{2}$ inches.

10. What is the volume of a block 3 inches by 4 inches by 10 inches?

11. How many bricks 8 in. \times 4 in. \times 2 in. will equal a cubic foot?

12. Find the contents of a box 12 in. by 5 in. by $2\frac{1}{2}$ in.

1. How many cubic inches will a box contain if it is 9 in. long, 6 in. wide, and 5 in. deep?

2. How many cubic inches in a box 10 inches long, 8 inches wide, and 4 inches deep?

3. The three dimensions of a box are 12 in., 10 in., and 8 in. What are its contents in cubic inches?

4. I have 96 inch cubes; if I make a pile 8 inches long and 4 inches wide, how high can I make it?

5. Compare a 2-inch cube and a 4-inch cube as to length, area of side, and contents.

6. Find the contents of a 12-inch cube.

$$12 \times 12 \times 12 \text{ cubic inches} = 1728 \text{ cubic inches.}$$

7. What may we call a 12-inch cube?

We measure the contents of larger rectangular solids in **cubic feet**. Name some solids that might be measured in this way.

8. How many cubical blocks, each a foot long, would be needed for a rectangular pile 8 ft. long, 4 ft. wide, and 3 ft. high?

9. A granite block is 5 ft. long, 2 ft. thick, and 3 ft. wide. How many cubic feet does it contain?

10. A block of marble 9 ft. long, and 3 ft. square at each end contains how many cubic feet?

11. How many cubic feet in a 3-ft. cube? What may a 3-ft. cube be called?

Larger solids, as the earth removed in digging a cellar or ditch, are measured in **cubic yards**.

Learn :— **1728 cubic inches = 1 cubic foot.**

27 cubic feet = 1 cubic yard.

12. How many cubic yards (loads) of earth will be removed in digging a cellar 24 ft. by 12 ft. by 8 ft.?

1. Compare a 4-foot cube with a cubic yard.
2. Compare a 6-foot cube with a cubic yard.
3. What part of a cubic yard is a prism 2 ft. by 1 ft. by 3 ft.?
4. A 5-inch cube was cut from the corner of a 10-inch cube. What part remained?
5. If a cubic foot of granite weighs 165 lb., find the weight of a 6-inch cube of granite.
6. How many cubic yards of earth will be removed in digging a cellar 8 ft. deep, 12 ft. wide, and 18 ft. long?
7. A schoolroom 12 ft. high, 30 ft. long, and 28 ft. wide contains 40 pupils. How many cubic feet of air for each one?
8. If a cubic foot = 0.8 bu., how many bushels will a bin 3 ft. by 4 ft. by 6 ft. contain?
9. If a 3-inch cube weighs 8 lb., what will a 6-inch cube weigh?
10. How many boxes 2 in. by 3 in. by 4 in. can you pack in a case 4 ft. by 3 ft. by 2 ft.?
11. A block of granite 4 ft. square and $2\frac{1}{2}$ ft. thick weighs what, if a cubic foot weighs 165 lb.?
12. During a shower, 2 inches of rain fell. How many cubic feet fell on a lot 4 rd. by 6 rd.?
13. If I pay \$50 to have a cellar 8 ft. deep, 12 ft. wide, and 15 ft. long dug, what will it cost at this rate to hire a cellar 8 ft. deep, 15 ft. wide, and 18 ft. long dug?
14. How many bushels of wheat will a bin 8 ft. by 10 ft. and 4 ft. deep hold? (A cubic foot = $\frac{8}{27}$ of a bushel.)
15. A trench 40 rods long is dug 2 ft. deep and 18 in. wide. How many loads (cubic yards) of earth were removed?
16. 500 tons of granite are used in building an observatory. If a cubic foot weighs 165 lb., how many cubic feet were used?

1. If a block has two opposite surfaces each 3 in. by 2 in., into how many square prisms having a square inch for the square surfaces can it be divided?

2. If the whole block contains 18 cubic inches, how many cubic inches will each of these 6 square prisms contain?

3. How long then will each be?

4. How thick must a block 2 inches by 3 inches be to contain 18 cubic inches?

5. How long must a block 1 inch by 3 inches be to contain 12 cubic inches?

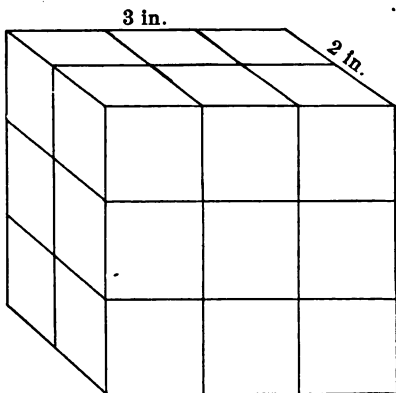
6. A rectangular solid contains 12 cubic inches. Two of its dimensions are 2 inches and 3 inches. What is the third? What is the third if the contents are 24 cubic inches?

7. If one surface of a rectangular solid contains 12 square inches, how many 1-inch cubes will it take to cover it? If the other dimension is 5 inches, what is the volume of the solid?

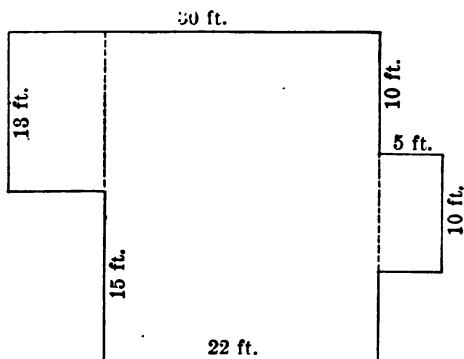
The surface upon which a solid rests is called its **base**, and the distance from this to the opposite surface is the **altitude** or **height**.

8. If the base contains 9 square inches and the height is 10 inches, what is the volume?

9. If the base contains 36 square inches and the volume is 108 cubic inches, what is the altitude?



1. The diagram represents the outline of a cellar 8 ft. deep. What will it cost to cement the floor at 27¢ per square foot?



2. How many cubic yards of earth had to be removed in digging it?

3. What was the cost of the digging at 60¢ per cubic yard?

4. If the walls cost 38¢ per square foot, what was the cost of walling?

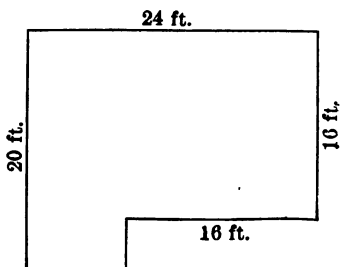
5. The dotted lines indicate partitions. What will they cost at 26¢ a square foot?

6. If the figure below is the outline of a cellar, divide it into rectangles and find the area of each.

7. How many square feet in the floor? What will it cost to cement the floor at \$2.75 per square yard?

8. How deep is the cellar if 3328 cubic feet of earth were removed in digging it?

9. Using the depth found in Exercise 8, find the total number of square feet in the walls.



10. A square prism 10 feet long contains 160 cubic feet. What is the length of one of the square surfaces?

11. Find the area of the walls of a room 16 ft. \times 12 ft. \times 9 ft. Allow one fifth for openings.



Firewood is generally cut into sticks 4 ft. long. A pile of these 4-ft. sticks, 8 ft. in length and 4 ft. high, is called a **Cord of wood**.

1. How many cubic feet in a *cord* ?

How many layers 1 foot thick in a cord ?

Each layer is made up of how many square prisms ?

How many cubic feet in each of these prisms ?

$$4 \times 4 \times 8 \text{ cu. ft.} = 128 \text{ cu. ft.} = 1 \text{ cord.}$$

2. One foot cut from the end of a cord is a **cord foot**. A cord foot contains $\frac{1}{8}$ of — cu. ft., or — cu. ft.

$$1 \text{ cord foot} = 16 \text{ cu. ft.}$$

3. What will $\frac{1}{2}$ cord of wood cost at \$1.75 per cord foot ?

4. What will $\frac{1}{2}$ cord cost at \$0.37 $\frac{1}{2}$ per cubic foot ?

5. How many cords in 640 cu. ft. ?

6. How many cords in a pile of 4-foot wood 12 ft. long and 8 ft. high ? What is it worth at \$6.75 ?

7. What will a pile of wood 10 ft. by 6 ft. by 4 ft. cost at \$12 a cord ?

8. If I pay 75 cents for sawing a cord of wood into 2 pieces, what shall I pay for sawing it into 3 pieces ?

1. Mention four factors of 72.
 2. What is the difference between an abstract and a concrete number?
 3. If 9 balls weigh 45 ounces, what will 18 balls weigh? What will 27 weigh?
 4. Count the change from a \$2-bill for $7\frac{1}{2}$ doz. buttons at 15 cents a dozen.
 5. How many times is $7\frac{1}{2}$ contained in $3\frac{3}{4} \times 7\frac{1}{2}$?
 6. If I spend $\frac{3}{4}$ of my money and \$12, I shall have nothing left. How much have I?
 7. $\frac{5}{8}$ of \$102 = what?
 10. \$15 is $\frac{3}{11}$ of what?
 8. 3% of 400 = what?
 11. 20 is 4% of what?
 9. Add $\frac{2}{3}$ and $\frac{3}{4}$.
 12. Take $2\frac{1}{2}$ from $3\frac{1}{4}$.
 13. A boy who works for \$3 a week pays 15 cents daily for his lunch and 60 cents a week for fares. How much has he left Saturday night?
 14. How many square yards in a tablecloth measuring 72 inches one way and $4\frac{1}{2}$ yards the other?
 15. How many pounds of sugar at $6\frac{1}{4}\text{¢}$ can I buy for \$1?
 16. 32 pounds is $33\frac{1}{3}\%$ of George's weight. How much does he weigh?
 17. If a horse trots a mile in 2 min. 8 sec., how long will he be in trotting 10 miles at that rate?
- Find the cost of:—*
- | | |
|-------------------------------------|---|
| 18. $\frac{3}{4}$ yd. calico @ 10¢. | 19. $8\frac{1}{2}$ lb. chicken @ 12¢. |
| $1\frac{1}{2}$ yd. ribbon @ 18¢. | 6 lb. steak @ $16\frac{2}{3}\text{¢}$. |
20. For what shall I sell a house that cost me \$1200 to gain 25%?

1. Compare the cost of $2\frac{1}{2}$ pounds of tea with the cost of 14 pounds.

2. Edward's age is $\frac{2}{3}$ of his cousin's. If Edward is 16, how old is his cousin?

3. How many chairs at \$2.50 can you buy for \$20?

4. How many pieces of ribbon $\frac{3}{4}$ yd. long can be cut from 7 yd.? How large a piece will remain?

See how quickly you can subtract the sum of each two of these numbers from their product:—

| | | | | | | | | | | | | |
|----|----------|----------|----------|----------|----------|----------|----------|----------|-----------|----------|----------|----------|
| 5. | 4 | 5 | 8 | 6 | 12 | 3 | 6 | 8 | 9 | 7 | 9 | 8 |
| | <u>8</u> | <u>4</u> | <u>2</u> | <u>5</u> | <u>8</u> | <u>7</u> | <u>7</u> | <u>6</u> | <u>10</u> | <u>8</u> | <u>7</u> | <u>5</u> |

6. 8% of 500? 8. $\frac{1}{8}$ of $\frac{3}{4}$? 10. $8\frac{1}{2}$ is $\frac{1}{12}$ of what?

7. $66\frac{2}{3}\%$ of 900? 9. $3\frac{2}{3} \times 12$? 11. \$12 is $8\frac{1}{3}\%$ of what?

12. What is the interest of \$200 for $2\frac{1}{2}$ yr. at 4%?

13. At 4%, what is the interest of \$1000 for 9 months?

14. After losing $\frac{1}{4}$ of his kite string, Charles had 600 ft. still remaining. How many feet had he originally?

15. How many inch cubes will a 2-inch cubical box hold? A 4-inch box will hold — times as many.

16. If you live 40 rd. from school, how many miles do you travel every week in going to school and returning?

17. Count by 13's from 0 to 104. 19. 100 eggs = — doz.

18. Count by $3\frac{1}{2}$ from 0 to 50. 20. 100 oz. = — lb.

21. What will 1500 cu. ft. of gas cost at \$2 a thousand?

22. How many pounds of tea at $37\frac{1}{2}$ cents a pound can you buy for 75 cents? For \$2.25?

23. A house rents for \$300 per year. If this is 6% of the cost, what did the house cost?

1. What part of 100 is 25? 75? $16\frac{2}{3}$? $66\frac{2}{3}$? $12\frac{1}{2}$? $62\frac{1}{2}$? $87\frac{1}{2}$?
2. What number multiplied by itself = 16? 36? 25? 81? 49?
3. One of the two equal factors of a number is called its *square root*. The square root of $64 = 8$, for $8 \times 8 = 64$.

$\sqrt{81}$ = the square root of 81, or 9. $\sqrt{100} = \text{---}$; $\sqrt{4} = \text{---}$;
 $\sqrt{121} = \text{---}$; $\sqrt{144} = \text{---}$; $\sqrt{400} = \text{---}$.

4. Compare a cubic foot and a cubic yard.
5. Compare the weight of a cubic inch and a cubic foot.
6. A barrel of flour weighs 196 pounds. What does a bag containing $\frac{1}{4}$ of a barrel weigh?

What shall I be obliged to pay for:—

- | | | |
|-----------------------------|-----------------------------|------------------------------|
| 7. $\frac{3}{4}$ lb. @ 25¢; | 8. $\frac{7}{8}$ yd. @ 50¢; | 9. $\frac{5}{8}$ doz. @ \$1; |
| $1\frac{1}{2}$ lb. @ 50¢? | $\frac{3}{8}$ doz. @ 10¢? | $\frac{1}{8}$ doz. @ \$2? |

10. At \$6 a cord, what will 1 cord foot of wood cost?
 11. At \$8 a ton, what will 3000 lb. of coal cost?
 12. At \$9 a year, what shall I pay for a newspaper for 2 mo.?
 13. $0.8 \times 0.6 = \text{---}$.
 16. $87\frac{1}{2}\%$ of 640 = --- .
 14. $4.8 \div 0.4 = \text{---}$.
 17. $33\frac{1}{3} \div 16\frac{2}{3} = \text{---}$.
 15. 0.0001 of 4800 = --- .
 18. $87\frac{1}{2} + 12\frac{1}{2} = \text{---}$.
 19. How many aprons each requiring $\frac{3}{4}$ of a yard can be made from 18 yards of cloth?
 20. If $\frac{5}{8}$ of a pound costs 15¢, what will $\frac{3}{8}$ of a pound-cost?
- HINT. Compare $\frac{3}{8}$ with $\frac{5}{8}$.
21. Take $\frac{2}{3}$ of a number out of it, and 36 remains. What is the number?
 22. If \$24 is the interest at 6%, what is the interest at 8%?
 23. The sum of three numbers is 30. The first is $8\frac{1}{2}$, and the second $7\frac{1}{2}$. Find the third.

1. If 12 lb. of starch cost \$0.72, what will $8\frac{1}{2}$ lb. cost?
2. If 4 men can build a fence in 12 days, how many days will 9 men require?
3. Change these fractions to per cents: $\frac{1}{2}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, $\frac{7}{8}$.
4. My telephone rent is \$27 per year. What shall I have to pay for 5 months?
5. What is a year's interest of \$40 at $4\frac{1}{2}\%$?
6. 1% of a man's age is 3 months. How many years old is he?
7. Bought a pair of boots for \$6 and sold them at a loss of $16\frac{2}{3}\%$. How much did I receive for them?
8. Take $13 + 17 + 19 + 21 + 25$ from 200.
9. How many square rods in $\frac{7}{8}$ of an acre?
10. A piece of ground contains an acre and is 10 rd. wide. How long must it be?
11. At \$10 a week, what is my board bill for 15 days?
12. A grocer buys a barrel of pork — 200 lb. — for \$12, and sells it at 8¢ a pound. What does he gain on a pound? On the barrel? What is his per cent of gain?
13. If $\frac{5}{8}$ of a ton of coal costs \$4, what will $2\frac{1}{2}$ tons cost? (Compare $2\frac{1}{2}$ and $\frac{5}{8}$.)
14. What is my December milk bill? I take 3 qt. daily. The price is 8¢ a quart.
15. Find the cost of 20 eggs at 18 cents a dozen.
16. $\frac{2}{3}$ of 42 = —.
17. 48 is $\frac{2}{3}$ of 72.
18. 21 is $87\frac{1}{2}\%$ of —.
19. $\frac{3}{4}$ of $6\frac{3}{4}$ = —.
20. $\frac{7}{8} \div \frac{3}{8}$ = —.
21. $9 \times 4\frac{2}{3}$ = —.
22. $\frac{2}{3} + \text{—} = 1\frac{1}{3}$.
23. $\frac{2}{3} \times \text{—} = 12$.
24. 18 is 36% of —.
25. 16 is — % of 64.
26. What is the interest of \$10 for 24 days at 6% ?

1. What does the denominator of a fraction show ?
2. How may you know the denominator of a decimal fraction ?
3. Compare the cost of 4 oranges with the cost of 12 oranges.
4. If 4 oranges cost $6\frac{3}{4}$ ¢, what will 12 oranges cost ?
5. Compare the cost of 15 hats with the cost of 3 hats.
6. If 15 hats cost \$26, what will 3 hats cost ?
7. What per cent of the letters in *Columbus* are vowels ?
8. What percent are these numbers of 144: 72? 48? 36? 24? 12?
9. Give the difference between 100 and 67; 84; 19; 37; 46.
10. Quickly mention the factors of 144; 121; 96; 72; 63; 108.
11. Give the squares of 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12.
12. What is the value of $\sqrt{36}$; $\sqrt{25}$; $\sqrt{64}$; $\sqrt{81}$; $\sqrt{49}$; $\sqrt{144}$?

What must you pay for these articles:—

- | | |
|--|--|
| 13. $\frac{1}{2}$ yd. gingham @ \$0.37 $\frac{1}{2}$. | 15. $\frac{1}{4}$ doz. pins @ \$0.66 $\frac{2}{3}$. |
| 14. $\frac{3}{4}$ yd. silk @ \$1.25. | 16. 2 $\frac{1}{4}$ lb. butter @ \$0.19. |

Find the selling price of an article when the —

17. Cost = \$12; gain = 12 $\frac{1}{2}$ %.
19. Cost = \$1.50; gain = 30%.
18. Cost = \$15; loss = 66 $\frac{2}{3}$ %.
20. Cost = \$2.75; loss 20%.
21. Compare the interest of \$60 with that of \$180.
22. What is the interest of \$50 for 60 days at 6%?
23. Find 8 months' interest, at 9%, of \$500.
24. Divide 75 cents among 3 boys, giving the first 9 cents more than each of the others.
25. How many times is 8 $\frac{1}{4}$ % of 48 contained in $\frac{1}{16}$ of 112?
26. What will 3 doz. lemons cost at 4 for 12¢? (Compare 3 doz. with 4.)

a. \$829.84.

b. 649.76.

c. 457.83.

d. 804.70.

e. 369.64.

f. 184.78.

g. 697.23.

h. 854.35.

i. 564.87.

j. 896.36.

k. 465.93.

l. 840.67.

m. 295.48.

n. 364.21.

o. 967.99.

1. Without rewriting the numbers at the left, find the sum from *a* to *g* inclusive.

2. Add from *b* to *k* inclusive.

3. Add from *o* to *g* inclusive.

4. Find the sum from *d* to *o* inclusive.

5. Find the difference between *a* and *b*.

6. Add $d - c$ to $e - f$.

7. Add $h - g$ to $k - m$.

8. Take the smallest number in the column from the sum of the largest two.

9. Add $4 \times a$ to $6 \times l$.

10. Take $\frac{1}{3}$ of *k* from $\frac{1}{4}$ of *e*.

11. Find the sum of the column.

12. Use this column for practice in addition as your teacher may dictate.

13. What number shall I obtain by adding 637 to itself 97 times?

14. I bought 27 horses at \$135 each, and sold them at an average gain of \$14.50. What did I receive for them?

15. At \$14.75 each, how many tables can be bought for \$1000?

Find the amount of the following purchases:—

16. 18 tons coal @ \$5.75.

17. 27 bbl. flour @ \$4.69.

7½ cd. wood @ \$12.50.

208 bu. oats @ \$0.62½.

18. What should be my selling price for the above mentioned articles to gain 20%?

19. If 47 bbl. of apples sell for \$98.23, what will 59 bbl. sell for?

20. Take $\frac{2}{3}$ of 47,639 from $\frac{1}{3}$ of 73,620.

21. Divide 32½% of 0.18 by 25% of 2.4.

1. Four boys weigh 84, 75, 106, and 64 pounds respectively. What is the average weight? (The sum \div 4.)

2. Their ages are $11\frac{1}{8}$ yr., $9\frac{3}{4}$ yr., $12\frac{1}{4}$ yr., $8\frac{1}{4}$ yr. Find their average age.

3. Subtract $19\frac{1}{4}$ from $305\frac{1}{8}$.

4. $\frac{2}{3}$ of $2\frac{1}{2}$ = what?

Find the amount of the following sales:—

5. 3 boxes sardines @ \$8.75 a dozen.

6. $11\frac{1}{4}$ lb. @ $12\frac{1}{2}$ ¢.

5 jars ginger @ \$11.00 a dozen.

$1\frac{1}{8}$ oz. @ 25 ¢.

7. Draw a rectangle to represent a floor 18 ft. wide and 24 ft. long. How many breadths of yard-wide carpet will it require? Each breadth will be — yards long. What will the carpet cost at \$1.25 per yard?

8. If the carpet is only $\frac{3}{4}$ yd. wide, how many breadths will be needed? What will the carpet cost at \$1.37 $\frac{1}{2}$ a yard?

9. If a single rail is 2 rods long, how many will be needed for a mile of *double* railroad track?

10. What will ties enough for the track cost at $17\frac{1}{2}$ ¢ each, if they are laid 6 to a rod?

11. Draw 6 rectangles to represent the surface of a box 6 in. long, 4 in. wide, and 2 in. deep, and find the area.

12. If $\frac{2}{3}$ of a house is worth \$3755, what is $\frac{3}{4}$ of it worth?

13. What will 1200 lb. of coal cost at \$4.87 $\frac{1}{2}$ a ton?

14. $2\frac{1}{2}$ mi. = — ft.

17. $4\frac{7}{8}$ cu. ft. = — cu. in.

15. $6\frac{1}{4}$ sq. ft. = — sq. in.

18. $3\frac{3}{4}$ A. = — sq. in.

16. 1280 ft. = — rd.

19. $41\frac{5}{8}$ cd. = — cu. ft.

20. If a cubic foot weighs 484 lb., what will 864 cu. in. weigh?

21. Reduce \$375.80 by 37% of itself.

1. Edwin Gay, who lives in Albany, pays Mrs. Mary Howe for $8\frac{3}{4}$ weeks' board at \$9 a week. She gives him a receipt for the amount Aug. 27, 1894. Properly fill out for her the following—

BLANK RECEIPT

| | |
|---|-------------------------------|
| \$ Money (in figures). _____ | City. _____ Date <u>189</u> . |
| Received from _____ Name of person paying money. | |
| Amount of money received (in words). _____ <u>100</u> Dollars | |
| for _____ What paid. | |
| Signature of receiver. _____ | |

2. An oil tank is 6 ft. square and 4 ft. deep. How many gallons will it hold, every cubic foot containing $7\frac{1}{2}$ gallons?

3. Bought 8 barrels of kerosene, 42 gallons in a barrel, at $6\frac{3}{4}$ ¢, and sold it at $12\frac{1}{2}$ ¢ a gallon. How much did I gain?

4. How many yards of carpet will be needed for a flight of stairs of 12 steps, each 8 in. high and 10 in. wide?

5. \$6 for 1500 lb. of coal is how much a ton?

6. From $42\frac{3}{4}$ yd. of silk $\frac{2}{3}$ of it was sold. What remains?

Find the cost of:—

7. 376 barrels @ \$4.62 $\frac{1}{2}$.

10. 10,768 sq. ft. land @ $11\frac{2}{3}$ ¢.

8. $1\frac{7}{8}$ yd. @ \$1.87 $\frac{1}{2}$.

11. $\frac{4}{15}$ of an A. @ \$275.

9. 17 gross @ $2\frac{3}{8}$ ¢.

12. 36 tons @ \$3.50 less 5%.

13. If $5\frac{1}{4}$ gal. cost \$9.40, what will $16\frac{1}{4}$ gal. cost?

14. At $18\frac{3}{4}$ mi. an hour, how long will 1000 mi. travel require?

15. \$80, or 16% of my money, was stolen. How much remained?

1. Make a drawing to represent a farm 80 rd. long and 60 rd. wide. What is its value at \$ 150 an acre?

2. How many cubic feet of earth will be removed in digging a cellar 20 ft. long, 16 ft. wide, and 8 ft. deep? How many loads, a cubic yard making one load?

3. Make out Charles Brackett's bill for $3\frac{1}{4}$ days' work for Dr. F. E. Bryant at \$ 2.75, and 300 ft. hemlock boards at \$ 16 per M. Receipt it for him.

4. David Allen pays you for $18\frac{1}{4}$ yd. of carpet at \$ 1.50. Write a suitable receipt for the money.

5. What is the capacity, in cubic feet, of a car 18 ft. long, 8 ft. wide, and 7 ft. high?

6. At $3\frac{1}{2}$ ¢ per square foot what shall I pay for a lot of land 225 ft. long and 96 ft. wide?

7. What shall I pay for a pile of 4-ft. wood 6 ft. high and 12 ft. long, at \$ 8 a cord?

8. What will settle a note that has been drawing interest for 105 days at 5%? Its face is \$ 80.

9. Bought a typewriter for \$ 120, and sold it for \$ 100. What per cent did I lose?

10. What per cent should I have gained if I sold it for \$ 150?

11. Bought oranges at the rate of 4 for a dime and sold them at the rate of 3 for a dime. Find the gain per cent.

12. A field 40 rods long contains 8 acres. How wide is it?

13. A mill costing \$ 12,500 was sold at a loss of 23%. Find the selling price.

14. How many cords in a pile of wood 80 ft. long, 4 ft. high, and 36 ft. wide?

15. How many days will it take a man to chop it if he can chop $1\frac{1}{2}$ cd. per day, and what will he earn at \$ 1.62 $\frac{1}{2}$ per day?

1. Find $\frac{1}{4}$ of $9 \times 3\frac{5}{8}$.
2. $0.1728 \div 0.8$ of 2.4.
3. $16\frac{4}{15} + 7\frac{2}{5} =$ what?
4. $16\frac{2}{3}\%$ of $8\frac{1}{2} \times \$0.24$.
5. 34 is 17% of what?
6. What per cent of 50 is $18\frac{3}{4}$?
7. How many acres in $\frac{3}{8}$ of a square mile?
8. If a wheel turns once in going $16\frac{1}{2}$ ft., how many times will it turn in going 8 mi.?
9. $3\frac{1}{2}$ cu. ft. = — cu. in.
10. 14 lb. 9 oz. = — oz.
11. 2000 in. = — yd. — ft.
12. $\frac{3}{16}$ of a sq. ft. = — sq. in.

Find what will pay for the following purchases:—

13. $16\frac{3}{4}$ bu. oats @ 53¢.
14. $8\frac{5}{12}$ doz. rakes @ \$8.00.
- $\frac{7}{8}$ ton hay @ \$18.
- $6\frac{7}{12}$ doz. shovels @ \$10.00.
- $2\frac{3}{8}$ bu. corn @ $66\frac{3}{8}$ ¢.
- $4\frac{1}{12}$ doz. hoes @ \$4.50.
15. At 75¢ a square rod, what will it cost to concrete a school yard 84 ft. long and 60 ft. wide?
16. After spending $\frac{7}{8}$ of my money and giving away $\frac{1}{12}$ of it, I had \$1.15 left. How much had I at first?
17. If you should hire money at $4\frac{1}{2}\%$ for a year and lend it at 6%, what would you make on every \$1000 of the principal?
18. The salary of the President of the United States is \$50,000 a year. What is this for a day?
19. Find the cost of a bushel when 3 pk. and 4 qt. cost 75 cts.
20. A pile of wood contains $3\frac{1}{2}$ cords; it is 4 ft. wide and 8 ft. high. How long is it?
21. The product of two numbers is $15\frac{1}{2}$; $\frac{3}{4}$ of one of them is 9. What is the other?
22. What is the value of a note for \$245, dated May 15, 1903, drawing 7% interest till Aug. 25, 1905?

1. William F. Haven buys of G. A. Ware & Co. $3\frac{3}{4}$ yd. of broad-cloth at \$5.75 a yard, and pays for it by giving them a *check*, that is, an order on a bank in which he has money deposited. Find the amount that should be inserted in the blank spaces.

A BANK CHECK

| | |
|---|--------------------------------|
| \$----- | <i>Chicago, Oct. 15, 1904.</i> |
| THE FIRST NATIONAL BANK | |
| <i>Pay to the order of ----- G. A. Ware & Co. -----</i> | |
| -----
<small>100</small> <i>Dollars.</i> | |
| <i>No. 16.</i> | <i>William F. Haven.</i> |

2. A *long* ton weighs 2240 pounds. I buy 1000 long tons of coal at the mines, and sell it by the short or ordinary ton. How many tons do I sell?

3. Multiply 0.008×5.76 and divide the product by 0.144.

4. I pay \$0.75 per square yard for reslating a blackboard 28 ft. long and $4\frac{1}{2}$ ft. wide. Find the cost.

5. How many days after July 4th does December 25th come?

6. What is the cost of a mahogany board $5\frac{1}{2}$ ft. long and 20 in. wide at \$1.25 a board-foot?

Make out bills for the following merchandise:—

7. 1600 ft. spruce @ \$24.50.

8. $3\frac{5}{12}$ doz. hats @ \$14.75.

900 ft. pine @ \$32.75.

$1\frac{7}{12}$ doz. hats @ \$8.50.

9. My room is 15 ft. by 11 ft. How many breadths of yard-wide carpet must I buy, and what will it cost at \$1.62 $\frac{1}{2}$ a yard?

10. What is the amount of \$488 at $4\frac{1}{2}\%$ interest from Aug. 27, 1903, to March 15, 1905?

1. $15\frac{1}{2}$ is $\frac{1}{2}$ of one number and $\frac{1}{2}$ of another. What is the difference between the two numbers?

2. I spend $\frac{2}{3}$ of my money and $\frac{1}{2}$ of the remainder. What part have I left?

3. $12\frac{1}{2}\%$ of a certain sum of money is \$ $12\frac{1}{2}$ less than $16\frac{2}{3}\%$ of it. What is the sum?

4. A pile of wood 6 ft. high covers 40 sq. ft. of ground. What is the pile worth at \$7 a cord?

5. Compare the lengths, areas, and contents of a 4-foot cube and an 8-foot cube.

6. I lost \$200 by selling a house for $8\frac{1}{3}\%$ less than its cost. Find cost and selling price.

7. A note for \$125 has been drawing 8% interest since May 24, 1901. What is the value of the note June 5, 1904?

8. Paul missed 48 words in a month out of 576 which were given him. What per cent did he spell right?

Find the amount of the following sales:—

| 9. | 10. | 11. |
|----------------------------|--|--------------------------|
| $\frac{3}{4}$ lb. @ \$0.25 | $\frac{5}{12}$ doz. @ \$3.00 | 800 lb. @ \$4 a ton |
| $\frac{1}{3}$ lb. @ 0.50 | $1\frac{1}{12}$ doz. @ 1.00 | 1600 lb. @ 6 a ton |
| $1\frac{1}{2}$ yd. @ 1.00 | $2\frac{1}{12}$ doz. @ 0.75 | 9500 ft. @ 18 a thousand |
| $\frac{1}{4}$ yd. @ 1.25 | $5\frac{1}{2}$ doz. @ 1.87 $\frac{1}{2}$ | 1200 ft. @ 24 a thousand |
| $\frac{1}{8}$ lb. @ 0.80 | $\frac{1}{12}$ doz. @ 15.00 | 750 ft. @ 60 a thousand |

12. A workman receives $16\frac{2}{3}\%$ a hundred for making screws. If he makes 150 in an hour, how much does he earn in a day of 10 hours?

13. A box 3 feet wide and $4\frac{1}{2}$ feet long contains 37 cubic feet. How deep is it?

14. Find the interest of \$275 for 1 yr. 7 m. 9 da. at $4\frac{1}{2}\%$.

1. Monday morning my cash on hand is \$157.86; Tuesday I buy 5000 lb. of hay at \$18 a ton; Wednesday I sell 1584 sq. ft. of land at $18\frac{1}{4}$ ¢; Thursday I pay 5 months' rent at \$400 a year. How much money have I on hand Friday morning?

2. If $11\frac{1}{2}$ doz. eggs cost $\$3\frac{4}{5}$, what will $18\frac{1}{4}$ doz. cost?

3. At \$23.75 each, how many mattresses may be bought for \$500, and how much money will remain?

4. If a cubic foot of ice weighs 57 pounds, what will be the weight of a rectangular piece $2\frac{1}{2}$ ft. by 1 ft. by 2 ft.?

5. What number must be added to $175\frac{5}{2}$ to make $317\frac{1}{4}$?

6. A certain schoolroom is $30\frac{1}{2}$ ft. long, 25 ft. wide, and 12 ft. high. How many cubic feet of air does it contain?

7. What did its hard pine floor cost at \$56 per M.?

8. On one side and end are blackboards $4\frac{1}{4}$ ft. wide, costing $62\frac{1}{4}$ ¢ per square yard. Find their cost.

9. What is the price per thousand when 600 ft. of lumber costs \$18.42?

10. What will 4875 slate pencils cost at 30¢ a hundred?

11. A dealer paid \$1013.70 for 218 tons of coal, and sold it for \$1667.70. How much did he gain per ton?

12. If a field is 800 feet long and 685 feet wide, what will it cost to fence it at \$0.75 per rod?

13. How deep must a tin box 6 inches long and 5 inches wide be to hold a gallon?

14. A man bought 225 cords of wood at \$4.80 a cord and paid $\frac{2}{3}$ of it at the time of purchase. He sold 24 cords at \$5.50 and made another payment. What did he still owe?

1. A prism of marble 6 ft. long and 18 in. square is bought for \$2.75 per cubic foot. Find the cost.

2. It costs \$0.75 a square foot to polish it. What will be the expense of polishing one end and the sides?

3. A farmer sells his crop for \$1562.75. He has hired a man 5 months, at \$35 a month, and two boys 147 days each, at \$2.50 a week. If his remaining expenses were \$423.75, what were his profits?

4. What part of a cord is 96 cubic feet?

5. What part of a cubic foot is an 8-inch cube?

6. Find the average age of four girls whose ages are $12\frac{2}{3}$ yr., $13\frac{1}{2}$ yr., $15\frac{3}{4}$ yr., and $11\frac{1}{8}$ yr.

7. \$16 is 40% of the cost of my watch. Should I gain or lose, and how much, if I sold it for \$50?

8. Make out Cyrus Rand's bill for Mrs. Emma Wyman. He owes for $13\frac{1}{4}$ weeks' board at \$9, and for $4\frac{7}{8}$ months' rent of rooms at \$12.

9. A grocer bought 164 lb. of butter for \$52.48, and sold 75 lb. of it at $37\frac{1}{2}\%$, and the rest of it at cost. What did he gain?

10. A piano that cost \$400 was sold for \$375. What per cent was lost?

11. Find the amount of \$165.95 for 3 mo. 19 da. at 7% interest.

12. My gas bill is \$12.85. I pay at the rate of \$1.80 a thousand feet. How many feet did I burn?

13. Compare the length, surface, and volume of a 6-ft. cube and a cubic yard.

14. If $14\frac{2}{3}$ bbl. of apples cost \$55, what will $5\frac{1}{2}$ bbl. cost?

15. If I buy 16 acres of land for \$3200, for how much must I sell it per acre to gain $\frac{2}{3}$ of the buying price?

1. Find the difference between $\frac{1}{16}$ and $66\frac{2}{3}\%$.
2. What will $38\frac{7}{8}$ yards cost at \$2.15 a yard?
3. How many gallons at $16\frac{1}{8}\phi$ each can be bought for \$144?
4. What will 78,250 bricks cost at \$8.75 per M.?
5. Find the cost of 725 pails at \$1.50 per dozen.
6. $6\frac{3}{8}\phi$ per square foot, how many square feet can I buy for \$252?
7. At \$1.75 per rod, what will it cost to fence a field $\frac{1}{2}$ a mile long and $\frac{1}{4}$ a mile wide?
8. What will it cost to plow this field at \$2.50 per acre?
9. How much money will be needed to pay the weekly wages in a manufactory employing
 - 16 hands, 8 hours a day, for 4 days, at $16\frac{2}{3}\phi$ per hour;
 - 12 hands, $9\frac{1}{2}$ hours a day, for 6 days, at 20ϕ per hour;
 - 19 hands, $7\frac{3}{4}$ hours a day, for 6 days, at 15ϕ per hour?
10. $5 \div 0.05$ less $0.05 \div 5$.
11. $0.006 \times 108\frac{1}{2} \div 400$.
12. 3 yd. of ribbon contain 216 sq. in. How wide is the ribbon?
13. Mr. Farmer sells Mr. Wagner 25 bu. potatoes at \$0.62 $\frac{1}{2}$; 9 bu. onions at \$1.13; 84 lb. butter at \$0.33 $\frac{1}{8}$; 13 doz. eggs at 28 ϕ . He buys of him 2 $\frac{1}{2}$ lb. tea at 75 ϕ ; 6 lb. coffee at 58 $\frac{1}{2}\phi$; 37 $\frac{1}{2}$ yd. cloth at 12 $\frac{1}{2}\phi$; sundries, \$3.72. How shall they settle?
14. The reading of my gas meter on July 1 was 57,000 cubic feet. On August 1 it was 59,500 cubic feet. What was my July bill at \$1.40 per 1000 cubic feet?
15. If the reading of my gas meter August 1 was 59,500 and my August bill at \$1.25 per 1000 cubic feet was \$2.75, what should have been the reading of the meter September 1?
16. Find the amount of \$640 at interest for 207 days at 7%.

1. If the interest on my money is \$128 for 8 mo., what will it be for 2 yr. 6 mo. ?

2. What will be the cost of 7 joists, each 16 ft. long, 4 in. wide, and 3 in. thick, at \$24 a thousand ?

3. From an acre of land I sold a piece 6 rd. square, and also 6 sq. rd. How much is left ?

4. James Clark collects rents for his father, who gives him a commission of 2% of all he collects. If he collects as follows, how much does he earn ?

Of Mr. Taylor 1 month's rent, at \$400 a year.

Of Mrs. Frye 2 months' rent, at \$200 a year.

Of Mrs. Tooney $\frac{3}{4}$ month's rent, at \$150 a year.

5. How many days can an engine be run with 14 tons of coal, if 735 pounds will run it one day ?

6. What shall I pay for 4300 cu. ft. of gas at \$2.50 per M., with a discount of 20% for cash ?

7. When taxes are \$15 on every \$1000, what shall I have to pay on property valued at \$3250 ?

8. From an acre of land the owner sold a lot 8 rd. wide and 12 rd. long. What per cent of the acre had he remaining ?

9. My coal bill for 1903 was \$132 at \$8.25 per ton. How many tons did I use ?

10. Canned tomatoes that cost \$2.40 for a 2 dozen crate sold at 15 cents a can. What was the gain per cent ?

11. May 16, 1904, you borrow \$500 of Thomas Rich, giving him your note at interest at 5%. Write the note and tell what will settle Aug. 28, 1905.

12. If I buy paper at \$2 per ream and sell it at 5% advance at retail, what do I get for 8 sheets ?

LIQUID MEASURES

Liquid Measures are used in measuring liquids, — milk, oil, wine, vinegar, etc.

DRY MEASURES

Dry Measures are used in measuring fruit, grains, roots, etc.

TABLE

| | |
|---------------|-------------------|
| 4 gills (gi.) | = 1 pint (pt.) |
| 2 pints | = 1 quart (qt.) |
| 4 quarts | = 1 gallon (gal.) |

TABLE

| | |
|----------|------------------|
| 2 pints | = 1 quart |
| 8 quarts | = 1 peck (pk.) |
| 4 pecks | = 1 bushel (bu.) |

NOTE. The dry quart is nearly equal to $1\frac{1}{4}$ liquid quarts.

AVOIRDUPOIS WEIGHT

Avoirdupois Weight is used in weighing all common articles.

TABLE

| | |
|-------------|--------------|
| 16 ounces | = 1 pound |
| 2000 pounds | = 1 ton (T.) |
| 2240 pounds | = 1 long ton |

TIME MEASURE

| | |
|-------------------|-----------------------|
| 60 seconds (sec.) | = 1 minute (min.) |
| 60 minutes | = 1 hour (hr.) |
| 24 hours | = 1 day (da.) |
| 365 days | = 1 common year (yr.) |
| 366 days | = 1 leap year |

7 days = 1 week; 12 calendar months = 1 year; 100 years = 1 century.

MEASURES USED IN COUNTING

| | |
|---------------------------|---------------------|
| 12 units = 1 dozen (doz.) | 24 sheets = 1 quire |
| 12 dozen = 1 gross (gro.) | 20 quires = 1 ream |
| 20 units = 1 score | 10 reams = 1 bale |

LENGTH MEASURES

Length Measures have only one dimension, length. They are used in measuring lines or distances.

TABLE

| | |
|---------------------------|-----------------|
| 12 inches (in.) | = 1 foot (ft.) |
| 3 feet | = 1 yard (yd.) |
| 16½ feet, or
5½ yards | } = 1 rod (rd.) |
| 320 rods, or
5280 feet | |
| | = 1 mile (mi.) |

SQUARE OR SURFACE MEASURES

Square or Surface Measures have two dimensions, length and breadth. They are used in measuring surfaces.

TABLE

| | |
|-----------------------------|---------------------------|
| 144 square inches (sq. in.) | = 1 square foot (sq. ft.) |
| 9 square feet | = 1 square yard (sq. yd.) |
| 30½ square yards | = 1 square rod (sq. rd.) |
| 160 square rods | = 1 acre (A.) |
| 640 acres | = 1 square mile (sq. mi.) |

SOLID OR CUBIC MEASURES

Solid or Cubic Measures have three dimensions, length, breadth, and thickness. They are used in measuring solids or volumes.

TABLE

| | |
|-----------------------------|--------------------------|
| 1728 cubic inches (cu. in.) | = 1 cubic foot (cu. ft.) |
| 27 cubic feet | = 1 cubic yard (cu. yd.) |
| 16 cubic feet | = 1 cord foot (cd. ft.) |
| 8 cord feet, or 128 cu. ft. | = 1 cord (cd.) |

DEFINITIONS

These definitions, arranged alphabetically, are given here mainly for reference. They may be used, if teachers desire, for review purposes.

Acute Angle. An angle less than a right angle.

Addend. A number to be added to another.

Addition. The process of combining numbers, two by two, into one sum.

Agent or Correspondent. One employed to transact business for another.

Aliquot Part. The quotient of any number divided by an integer.

Altitude. Height. Measured by a straight line perpendicular to the line of the base, and extending from it to the highest point.

Amount. The result of addition ; in computing interest, interest and principal added.

Angle. The divergence from a common point of two lines having different directions.

Antecedent. The first term of a ratio ; the dividend.

Arabic System of Notation. So called because it came into Europe from Arabia, and was brought by Arabs from India.

Arc. Any portion of a circumference.

Area. The size or total contents of a surface.

Base. The line or surface on which a figure is supposed to stand.

The number of which a percentage is taken.

Bill. An itemized statement showing to whom and by whom goods have been sold, or services rendered, and giving dates, quantity, price, and amount.

Capital. Money or other property invested in business.

Check. A depositor's order for the payment of money by his bank.

Chord. A straight line joining the ends of an arc.

Circle. A plane surface bounded by a curve every point of which is equally distant from a point within called the center.

Circumference. The perimeter or boundary of a circle.

Commission. A percentage paid to an agent for transacting business for another.

Common Denominator of two or more fractions. One showing the size of some fractional unit in which all may be expressed.

Common Factor of two or more numbers. A number that is a factor of each of them.

Complex Decimals have a common fraction in the numerator, as $0.27\frac{1}{2}$.

Complex Fractions contain a fraction in the numerator, in the denominator, or in both.

Composite Number. The product of integral factors, 1 not included.

Compound Number. Two or more denominate numbers used to express one quantity; a denominate number having two or more integral units of the same kind of measure, as $3^{\circ} 5'$.

Consequent. The second term of a ratio; the divisor.

Convex Surface. The surface of a solid excluding that of its bases.

Couplet. The two terms of a ratio.

Cube. A solid with six square faces.

Cube (Number). The product of three equal numbers; the third power of a number.

Cube Root. One of the three equal factors forming a third power. $3 \times 3 \times 3 = 3^3$ or 27.

Decimal Fractions, or Decimals. Any number of 10ths, 100ths, 1000ths, etc.; commonly expressed at the right of the decimal point without written denominator.

Decimal Point. A period used after ones and before tenths.

Decimals. Decimal fractions written after the decimal point, without a denominator.

Decimal System of Numbers. A system in which *ten* units of any order make one unit of the next higher order.

Degree. A 360th part of a circumference when used to measure a circumference or a 360th part of a revolution when used in measuring angles.

Denominate Number. One in which the unit is a measure, as 3 lb.

Denominator. The lower term of a fraction. It shows into how many equal parts the integral unit is divided and thus *names* the fractional units according to their size.

Diagonal of a Polygon. A straight line connecting the vertices of two angles not adjacent.

Diameter. A line measuring the shortest distance across a circle through the center.

Difference. What must be added to the smaller of two numbers to make the larger.

Digits. The numbers for which the nine Arabic figures stand.

Dimensions. Measurements needed to find contents.

Discount. An allowance deducted.

Dividend. A number to be divided.

Division. The process of separating a number into equal parts, or of finding how many times one number is contained in another.

Divisor. A number to divide by; it shows *how large* or *how many* the equal parts of the dividend are to be.

Equation. Two quantities expressed as being equal.

Exact Divisor. One that gives an integral quotient without a remainder.

Exponent or Index. One or more figures written above and at the right of a number to show how many times the number is taken as a factor.

Face of Note, Check, or Draft. The sum for which it is written.

Factors. Numbers multiplied together in making a product; commonly used as meaning integral factors.

Figure. A surface bounded by lines or a space bounded by surfaces.

Fraction. One or more of the equal parts of an integral unit.

Greatest Common Factor, Divisor, or Measure. The largest factor found in each of two or more numbers.

Horizontal. Parallel to the plane of the horizon.

Improper Fraction. A number not less than 1 expressed in the form of a fraction.

Inclined. Neither horizontal nor vertical.

Insurance. Compensation for loss by fire or other disaster.

Integer. A whole number of which the lowest unit is *one*, not any part of one.

Interest. An allowance to the owner for the use of his money.

Invoice. A bill of goods sold.

Least Common Denominator of two or more fractions. One showing the size of the largest fractional unit in which all can be expressed.

Least Common Multiple of two or more numbers. The smallest number of which each is a factor.

Like Fractions have fractional units of the same size and kind.

Like Numbers have units of the same size and kind.

Line. The limit of a surface. The path of a point.

Maker of a Note. The one who makes the promise and signs it. The promisor.

Maturity. The time when a note, draft, or bond falls due and is legally payable.

Minuend. A number to be lessened.

Mixed Decimal. A number consisting of an integer and a decimal fraction.

Mixed Number. An integer and a fraction taken together.

Multiple of a number. A number of which it is a factor.

Multiplicand. One of the equal numbers to be combined by multiplication; the factor to be repeated in making a product.

Multiplication. The process of combining equal numbers, by repetition, into one product. It repeats one number "many fold."

Multiplier. The factor that shows how many equal numbers are to be combined in the product.

Net Price or Cost. The price or cost after all discounts or charges have been deducted.

Notation. A system of writing numbers in figures or letters.

Note, demand. One payable at the demand of the holder.

Note, time. One payable at a specified time.

Note, interest-bearing. One containing the words "with interest."

Number. That which answers the question "How many?"; one or more units.

Numeration. A system of reading numbers expressed in figures.

Numerator. The upper term of a fraction. It *numbers* the fractional units contained.

Oblique lines are neither horizontal nor vertical. Oblique angles are greater or less than right angles.

Oblong. A rectangle whose length exceeds its breadth.

Obtuse angles are greater than right angles.

Parallel. Extending in the same direction, and in all parts equally distant.

Payee. The one to whom or to whose order a note, check, or draft is payable.

Per Cent. Number of hundredths; units out of a hundred.

Percentage. The process of computing by hundredths. The part of the base indicated by the rate per cent.

Perimeter. The circumference of a surface or the sum of its bounding lines.

Period. One of the groups, of three figures each, counting from the units' place.

Perpendicular. At right angles to another line or surface.

Plane. A plane surface is a flat or level surface.

Point. That which has position, but no length, breadth, or thickness. The end of a line.

Polygon. A plane surface having straight sides, commonly more than four.

Power. The product of two or more equal numbers as factors.

Prime Number. A number with no other factor than itself and 1.

Principal. A sum upon which interest may be allowed.

Prism. A solid whose sides are parallelograms, and whose bases are equal parallel polygons. Prisms are named from the form of their bases, as *square* prisms, *rectangular* prisms, *triangular* prisms, *hexagonal* prisms, etc.

Product. The result of multiplication.

Promissory Note. A written promise to pay a specified sum of money.

Proper Fraction. A number less than 1.

Quadrant. A fourth part of a circle or of a circumference.

Quadrilateral. A plane surface having four straight sides.

Quotient. The result of division.

Radius. A straight line extending from center to circumference of a circle.

Rate of interest. Per cent of the principal allowed for a year's use of it.

Rate Per Cent. The number of hundredths used in finding a percentage.

Ratio. The relative size of two numbers, expressed by their quotient.

Reciprocal of a Fraction. $1 \div$ the fraction, or the fraction inverted.

Reciprocal of a Number. $1 \div$ the number; the fractional unit expressed by that number as denominator, as $3, \frac{1}{3}$.

Rectangle. A parallelogram having four right angles.

Rectilinear. Bounded by straight lines.

Reduction. Changing the unit of a number without changing its value.

Remainder. What is left when part of a number is taken away.

Right Angle. An angle of 90° .

Roman System of Notation. So called because invented and used by the Romans.

Semicircle. Half of a circle.

Sextant. One sixth of a circle.

Simple Fraction. One having only integral terms.

Solid. A form having three dimensions, — length, breadth, and thickness.

Square. An equilateral rectangle. A plane surface with four equal sides and angles.

Square (Number). The second power, or the product of a number multiplied by itself.

Square Root. One of the two equal factors of a square, or second power.

Subtraction. The process of taking part of a number out of it to find the remainder; finding the difference between two numbers.

Subtrahend. A number to be subtracted from another.

Surface. That which has only two dimensions, — length and breadth. The outside of a solid.

DEFINITIONS

Terms of a Fraction. The numerator and denominator.

Terms of a Ratio. The antecedent and consequent.

Triangle. A plane surface having three straight sides. A *right triangle* has one right angle; an *obtuse triangle* has one obtuse angle; an *acute triangle* has three acute angles. The angles of a triangle are together equal to two right angles, 180° .

Unit. One; a single thing; any standard by which a quantity of the same unit is measured.

Vertex. The point in an angle where the sides meet.

Vertical. Relating to the vertex.

Vertical lines point towards the zenith and the earth's center.

+, plus; and; the sign of addition.
-, minus; less; the sign of subtraction.

×, times; multiplied by; the sign of multiplication.

÷ or ∴, divided by; signs of division.

), in; a sign of division.

—, /, (as in $\frac{1}{2}$, $\frac{2}{3}$), signs of division.

=, equals, or equal; the sign of equality.

\$, dollar or dollars.

%, hundredths; per cent.

Ct., c., or ¢, cent or cents.

@, at (the rate of).

∴, therefore.

() as in $(3 + 4) \times 5 = 35$ } *curves* or
as in $3 + 4 \times 5 = 35$ } *vinculum*,
shows that the numbers inclosed or beneath are to be treated as one number.

$\sqrt{\quad}$, the square root of.

$\sqrt[3]{\quad}$, the cube root of.

6%, $\frac{6}{100}$, .06, or 6 per cent.

2^2 , 2^3 , as in 5^2 = the square of 5, or 25;
 4^3 = the cube of 4, or 64.

Dr., debtor.

Cr., creditor.

G.C.D., greatest common divisor.

L.C.M., least common multiple.

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ANSWERS

SECOND BOOK — PART I

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1. 1574.
2. 1982.
3. 2058.
4. 3113.
5. 16471.
6. 41466.
7. 38525.
8. 40402.

Page 5

14. 59290.
15. 373968.
16. 299960.
17. 690862.
18. 788900.
19. 547048.

Page 6

1. 13592.
2. 61219.
3. 76482.
4. 43048.
5. 89202.
6. 26754.
7. 4693.
8. 2972.
9. 14229.
10. 2183.
11. 74387.
12. 29253.
13. 74494.

14. 39890.
15. 80263.
16. 15134.
17. 29136.
18. 42206.
19. 11813.
20. 842.
21. 252726.
22. 28380.
23. 41138.
24. 79058.
25. 27825.
26. 44045.
27. 24410.
28. 39169.
29. 9539.
30. 59860.
31. 264305.
32. 176320.
33. 2048.
34. 62542.
35. 18620.
36. 57309.
37. 46053.
38. 57041.
39. 75248.
40. 3658.
41. 50033.
42. 209812.
43. 7348.
44. 44936.
45. 14271.

46. 27.
47. 29357.
48. 4496.
49. 86676.
50. 18982.
51. 87979.
52. 31966.
53. 1988.
54. 3158.
55. 8939.
56. 41888.
57. 24443.
58. 39234.
59. 2416.
60. 1341.
61. 372113.
62. 873.
63. 33356.
64. 39168.
65. 52438.
66. 28911.
67. 4726.
68. 3037.
69. 2274.
70. 60702.
71. 11579.
72. 204700.
73. 39090.
74. 16516.
75. 46445.
76. 13264.
77. 21643.

78. 17872.
79. 84787.
80. 56202.
81. 314338.
82. 33492.
83. 9396.
84. 17606.
85. 32891.
86. 57282.
87. 75410.
88. 61539.
89. 11428.
90. 15324.

Page 8

4. \$186.
5. \$302.45.
6. \$119.32.
7. \$183.36.
8. \$441.75.
9. \$442.26.
10. \$162.54.
11. \$369.75.
12. \$581.67.
13. \$1214.01.
14. \$5490.54.
15. \$4894.56.
16. \$2239.05.
17. \$3979.86.
18. \$6410.25.
19. \$6404.15.
20. \$180.93.

21. \$5714.73.
 22. \$2425.44.
 23. \$6529.55.
 24. \$351.00.
 25. \$4481.16.
 26. \$8164.32.
 27. \$678.61.
 28. \$570.75.

Page 11

2. 67 ft.
 3. 76; 16 yd.
 4. 164 mi.; 24
 mi.

5. 124; 44.
 6. 1900.
 7. 800.
 8. 25.
 9. \$461.
 10. 46; 18.
 11. 123; 51.
 12. 99; 80.
 13. 56; 24.
 14. 79; 15.
 15. 147; 76.
 16. 151; 50.
 17. 403; 3.
 18. 191; 90.
 19. 423; 22.
 20. 2029; 17.
 21. 1218; 514.
 22. 596; 263.
 23. 770; 558.
 24. 1011; 585.
 25. \$1337.
 26. \$328; \$18 un-
 divided.
 27. \$110; \$1 un-
 divided.
 28. \$1124; \$29
 undivided.

Page 12

1. 7809.
 2. 80060.
 3. 703755.
 4. 39.
 5. 759.
 6. 24.
 7. \$3.
 8. 20 bbl.
 9. \$465.98.
 10. 28.
 11. 2333½.

Page 13

1. \$134.11;
 Smith.
 2. \$6.77 and one
 \$6.78.
 3. \$234.
 4. 34 bu. and 30¢
 yet unpaid.
 5. \$289.
 6. \$11.95.
 7. \$1695.
 8. \$2160; the
 house.
 9. 46 ft.

Page 18

2. 329,832.
 3. 665,280.
 4. 809,951.
 5. 239,765.
 6. 561,446.
 7. 587,736.
 8. 345,144.
 9. 410,163.
 10. 300,352.
 11. 803,656.
 12. 621,453.
 13. 599,256.

14. 672,670.
 15. 564,682.
 16. 690,656.
 17. 7,883,106.
 18. 7,324,332.
 19. 5,489,727.
 20. 2,548,623.
 21. 3,346,830.
 22. 7,350,260.
 1. \$518.84.
 2. \$351.12.
 3. \$1424.

Page 23

1. \$175; \$425.
 2. \$13.60.
 3. \$63.
 4. \$93; \$279.
 5. \$220.
 6. \$4050.
 7. 99 ft.
 8. 9 in.
 9. 5 sq. in.
 10. 10 in.; 6½ sq.
 in.
 11. ½; \$1.84.
 12. ½.
 13. 5 yr.
 14. ½; \$0.75.
 15. \$32.25.
 16. \$0.84.

Page 26

2. 12 sq. yd.
 3. \$2.50; \$7.50.
 4. 93½ acres.
 5. 282 ft.
 6. 3136.
 7. ½.
 8. 959 apples.
 9. 120 acres.

10. 9600 sq. rd.
 11. 60 acres.
 12. 206 oranges.
 13. \$560.
 14. \$4629.

Page 30

2. \$281.25.
 3. \$336.
 4. \$26.25.
 5. \$42.75.
 7. 2592.
 8. 10 da., and 7
 tons left.
 9. \$334.47.
 10. 192 sq. in.
 11. \$33.75.
 12. \$735.
 13. \$756.

Page 31

1. ½; \$15.
 2. \$74.
 3. ½; \$1080.
 4. \$195.
 5. \$310; \$1240.
 6. \$22.50.
 7. 2540.
 8. 43; 989.
 9. ½; \$93.
 10. \$421.
 11. ½; 549½.
 12. \$2940.
 13. ½; 444.
 14. \$744.
 15. \$129.78.

Page 33

1. 24 lots.
 2. \$220.
 3. 80 carriages.

4. 108 lots.
5. 93.
6. 66.
7. 72.
8. 30.
9. 60.
10. 120.
11. \$22.75.
12. \$6.05 nearly.
13. \$5.07+.
14. \$8.75-.
15. \$29.17-.
16. \$38.78+.
17. \$11.04-.
18. \$1.17.
19. \$2.67.
20. \$20.03.
21. \$9.76.
22. \$12.96.
23. \$2.98.
24. \$2.38.
25. \$45.68.
26. \$4.37.
27. \$0.06.
28. \$0.21.
29. \$2.09.
30. \$25.32.

Page 36

1. 18; 50¢.
2. \$14.
3. 716.
4. 186 sq. ft.
5. \$11.56.
6. \$24.86.
7. 654.
8. 149.
9. 6274.
10. \$4290.
11. \$8.83.
12. 12 in.

13. 8640 sq. ft.
14. \$3240.
15. \$20.90.
16. \$4.05.
17. \$1814.40.

Page 37

1. \$12.32.
2. \$12.73.
3. \$38.35.
4. 178.
5. 9.
6. 9600.
7. \$805.
8. \$1706.25.
9. \$2009.25.
10. \$199.80.
11. \$1828.13.
12. \$214.
13. \$1.20.
14. 65 gal.

Page 43

- A. \$14,174.35.
- B. \$28,181.01.
- C. \$15,611.14.
- D. \$23,499.27.
- E. \$235.84.
- F. \$3,208,160.56.

1. \$741,080.62.
2. \$483,594.53.
3. \$103,813.28.
4. \$915,979.32.
5. \$51,321.74.
6. \$907,247.81.
7. \$86,824.87.
8. \$2099.03.
9. \$4485.56.
10. \$4473.25.
11. \$15054.52.
12. \$22136.99.

13. \$2386.53.
14. \$2374.22.
15. \$12955.49.
16. \$20037.96.
17. \$12.31.
18. \$10568.96.
19. \$17651.43.
20. \$10581.27.
21. \$17663.74.
22. \$7082.47.
23. 2,370,633.
24. 8496776.
25. 5054632.
26. 4500023.
27. 4563694.
28. 7233141.
29. 2501973.
30. 2989821.
31. 3320043.

Page 48

1. 104 mi.
2. 21.
3. 8.
4. 64.
5. \$3760.
6. \$6.75.
7. \$2800.
8. 196 $\frac{1}{4}$.
9. \$5.77.
10. \$944.
11. \$10.
12. 71 yr.

Page 50

18. 21 $\frac{1}{2}$ mi.
19. 20 $\frac{1}{4}$ bu.
20. 21 $\frac{1}{4}$ T.
21. 29 $\frac{1}{2}$ yd.
22. \$6.25.
23. 32 $\frac{1}{2}$ bu.

Page 56

1. $\frac{1}{2}$.
2. $\frac{1}{12}$.
3. $\frac{1}{2}$.
4. $\frac{1}{2}$.
5. $\frac{1}{15}$.
6. $\frac{2}{15}$.
7. $\frac{1}{15}$.
8. $\frac{1}{2}$.
9. $\frac{1}{15}$.
10. $\frac{1}{15}$.
11. $\frac{5}{15}$.
12. $\frac{1}{15}$.
13. $\frac{1}{2}$.
14. $\frac{1}{12}$.

Page 57

Sum; dif.

9. $\frac{1}{15}$; $\frac{1}{15}$.
10. $\frac{1}{2}$; $\frac{1}{2}$.
11. $\frac{1}{15}$; $\frac{1}{15}$.
12. $1\frac{2}{3}$; $\frac{1}{3}$.
13. $1\frac{1}{2}$; $\frac{1}{2}$.
14. $1\frac{1}{15}$; $\frac{1}{15}$.
15. $\frac{1}{15}$; $\frac{1}{15}$.
16. $1\frac{1}{15}$; $\frac{1}{15}$.
17. $\frac{1}{15}$; $\frac{1}{15}$.
18. $\frac{1}{15}$; $\frac{1}{15}$.
19. $1\frac{1}{15}$; $\frac{1}{15}$.
20. $\frac{1}{15}$; $\frac{1}{15}$.
22. 10.
23. 9 $\frac{1}{2}$.
24. 15 $\frac{1}{2}$.
25. 15 $\frac{1}{2}$.
26. 12 $\frac{1}{2}$.

Page 59

Sum; dif.

2. $1\frac{1}{15}$; $\frac{1}{15}$.
3. $1\frac{1}{15}$; $\frac{1}{15}$.
4. $1\frac{1}{15}$; $\frac{1}{15}$.

Sum; diff.

| | | | |
|--|-----------------------|------------------------|-------------------------|
| 5. $1\frac{5}{12}$; $\frac{1}{24}$. | 15. $1\frac{1}{2}$. | 56. $1\frac{1}{2}$. | 97. $54\frac{1}{2}$. |
| 6. $1\frac{1}{2}$; $\frac{1}{12}$. | 16. $1\frac{1}{2}$. | 57. $1\frac{1}{2}$. | 98. $64\frac{1}{2}$. |
| 7. $1\frac{1}{2}$; $\frac{1}{24}$. | 17. $1\frac{1}{2}$. | 58. $1\frac{1}{2}$. | 99. $29\frac{1}{2}$. |
| 8. $1\frac{2}{3}$; $\frac{1}{3}$. | 18. $1\frac{1}{2}$. | 59. $1\frac{1}{2}$. | 100. $21\frac{1}{2}$. |
| 9. $\frac{2}{3}$; $\frac{1}{3}$. | 19. $1\frac{1}{2}$. | 60. $1\frac{1}{2}$. | 101. $94\frac{1}{2}$. |
| 10. $1\frac{1}{2}$; $\frac{1}{10}$. | 20. $1\frac{1}{2}$. | 61. $1\frac{1}{2}$. | 102. $118\frac{1}{2}$. |
| 12. $165\frac{1}{2}$. | 21. $6\frac{1}{2}$. | 62. $\frac{1}{2}$. | 103. $122\frac{1}{2}$. |
| 13. $283\frac{1}{2}$. | 22. $5\frac{1}{2}$. | 63. $1\frac{1}{2}$. | 104. $105\frac{1}{2}$. |
| 14. $3\frac{1}{2}$. | 23. $3\frac{1}{2}$. | 64. $1\frac{1}{2}$. | 105. $72\frac{1}{2}$. |
| 15. $22\frac{1}{2}$. | 24. $5\frac{1}{2}$. | 65. $1\frac{1}{2}$. | 106. $144\frac{1}{2}$. |
| 16. $37\frac{1}{2}$. | 25. $2\frac{1}{2}$. | 66. $\frac{1}{2}$. | 107. $153\frac{1}{2}$. |
| 17. $43\frac{1}{2}$. | 26. $\frac{1}{2}$. | 67. $1\frac{1}{2}$. | 108. $156\frac{1}{2}$. |
| 18. $77\frac{1}{2}$; $49\frac{1}{2}$. | 27. $1\frac{1}{2}$. | 68. $1\frac{1}{2}$. | 109. $98\frac{1}{2}$. |
| 19. $44\frac{1}{2}$; $4\frac{1}{2}$. | 28. $4\frac{1}{2}$. | 69. $1\frac{1}{2}$. | 110. $71\frac{1}{2}$. |
| 20. $32\frac{1}{2}$; $4\frac{1}{2}$. | 29. $1\frac{1}{2}$. | 70. $1\frac{1}{2}$. | 111. $17\frac{1}{2}$. |
| 21. $87\frac{1}{2}$; $7\frac{1}{2}$. | 30. $4\frac{1}{2}$. | 71. $1\frac{1}{2}$. | 112. $35\frac{1}{2}$. |
| 22. $100\frac{1}{2}$; $12\frac{1}{2}$. | 31. $36\frac{1}{2}$. | 72. $\frac{1}{2}$. | 113. $13\frac{1}{2}$. |
| 23. $80\frac{1}{2}$; $41\frac{1}{2}$. | 32. $25\frac{1}{2}$. | 73. $\frac{1}{2}$. | 114. $29\frac{1}{2}$. |
| | 33. $12\frac{1}{2}$. | 74. $1\frac{1}{2}$. | 115. $12\frac{1}{2}$. |
| | 34. $8\frac{1}{2}$. | 75. $1\frac{1}{2}$. | 116. $77\frac{1}{2}$. |
| | 35. $19\frac{1}{2}$. | 76. $3\frac{1}{2}$. | 117. $89\frac{1}{2}$. |
| | 36. $36\frac{1}{2}$. | 77. $4\frac{1}{2}$. | 118. $78\frac{1}{2}$. |
| | 37. $40\frac{1}{2}$. | 78. $6\frac{1}{2}$. | 119. $59\frac{1}{2}$. |
| | 38. $28\frac{1}{2}$. | 79. $31\frac{1}{2}$. | 120. $34\frac{1}{2}$. |
| | 39. $65\frac{1}{2}$. | 80. $7\frac{1}{2}$. | 121. $2\frac{1}{2}$. |
| | 40. $70\frac{1}{2}$. | 81. $16\frac{1}{2}$. | 122. $1\frac{1}{2}$. |
| | 41. $69\frac{1}{2}$. | 82. $28\frac{1}{2}$. | 123. $1\frac{1}{2}$. |
| | 42. $82\frac{1}{2}$. | 83. $44\frac{1}{2}$. | 124. $1\frac{1}{2}$. |
| | 43. $73\frac{1}{2}$. | 84. $45\frac{1}{2}$. | 125. $2\frac{1}{2}$. |
| | 44. $52\frac{1}{2}$. | 85. $37\frac{1}{2}$. | 126. $1\frac{1}{2}$. |
| | 45. $30\frac{1}{2}$. | 86. $9\frac{1}{2}$. | 127. $1\frac{1}{2}$. |
| | 46. $1\frac{1}{2}$. | 87. $19\frac{1}{2}$. | 128. $1\frac{1}{2}$. |
| | 47. $1\frac{1}{2}$. | 88. $30\frac{1}{2}$. | 129. $1\frac{1}{2}$. |
| | 48. $1\frac{1}{2}$. | 89. $37\frac{1}{2}$. | 130. $2\frac{1}{2}$. |
| | 49. $1\frac{1}{2}$. | 90. $22\frac{1}{2}$. | 131. $1\frac{1}{2}$. |
| | 50. $1\frac{1}{2}$. | 91. $76\frac{1}{2}$. | 132. $1\frac{1}{2}$. |
| | 51. $1\frac{1}{2}$. | 92. $83\frac{1}{2}$. | 133. $2\frac{1}{2}$. |
| | 52. $\frac{1}{2}$. | 93. $108\frac{1}{2}$. | 134. $1\frac{1}{2}$. |
| | 53. $1\frac{1}{2}$. | 94. $75\frac{1}{2}$. | 135. $1\frac{1}{2}$. |
| | 54. $\frac{1}{2}$. | 95. $59\frac{1}{2}$. | 136. $80\frac{1}{2}$. |
| | 55. $1\frac{1}{2}$. | 96. $60\frac{1}{2}$. | 137. $87\frac{1}{2}$. |

Page 60

138. $115\frac{3}{4}$.
 139. $79\frac{1}{2}$.
 140. $67\frac{5}{10}$.
 141. $157\frac{3}{4}$.
 142. $177\frac{2}{10}$.
 143. $193\frac{1}{4}$.
 144. $139\frac{5}{10}$.
 145. $101\frac{1}{4}$.
 146. $148\frac{7}{10}$.
 147. $157\frac{1}{4}$.
 148. $163\frac{3}{4}$.
 149. $102\frac{7}{10}$.
 150. $79\frac{7}{10}$.

Page 61

2. 200 A.
 3. $\frac{1}{4}$.
 4. $\frac{3}{4}$; $\frac{1}{4}$; $\frac{1}{4}$.
 5. \$515.
 6. 230 mi.
 7. \$131.20.
 8. \$79.10.
 9. \$3587.
 10. $\frac{1}{4}$.
 11. 168 A.
 12. $\frac{1}{4}$; \$4.50.
 13. 476 bu.

Page 62

1. \$1.87.
 2. $\frac{3}{8}$; \$155.
 3. 24¢; 30¢; 45¢.
 4. 319 mi.
 5. \$3400; 4250.
 6. 21; 30.
 8. 200 sheep.
 9. 12,462 whites.
 10. \$3000.

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4. $\frac{1}{2}$; $\frac{1}{2}$.
 5. $1\frac{1}{2}$.
 6. $8\frac{1}{2}$.
 7. $1\frac{1}{2}$.
 8. $1\frac{1}{2}$.
 9. $9\frac{1}{2}$.
 10. $5\frac{1}{2}$.
 11. $2\frac{1}{2}$.
 12. $2\frac{1}{2}$.
 13. $4\frac{1}{2}$.
 14. $1\frac{1}{2}$.
 15. $1\frac{1}{2}$.
 16. $3\frac{1}{2}$.
 20. $2\frac{1}{2}$.
 21. $16\frac{1}{2}$.
 22. $5\frac{1}{2}$.
 23. $8\frac{1}{2}$.
 24. 20.
 25. 24.

Page 66

13. \$45.
 14. \$306.
 16. $301\frac{1}{2}$.
 17. 388¢.
 18. 2257¢.
 19. 2133¢.
 20. 1666¢.
 21. 2187¢.
 22. 1350.
 23. 1435¢.
 24. 453¢.
 25. 838¢.
 26. 3174¢.
 27. \$45.83¢.
 28. \$20.37¢.
 29. \$4.65¢.
 30. \$22.57¢.
 31. \$30.68.
 32. \$120.35.

Page 67

1. 9.98¢.
 2. 453 sq. in.
 3. \$139.50.
 4. $71\frac{1}{2}$ in.
 5. $89\frac{1}{2}$ ft.
 6. 510 ml.
 7. \$78¢.
 8. \$66.38¢.
 9. \$109.97¢.
 10. \$48.08¢.
 11. 36 cd.
 12. \$16.20.
 13. 105 qt.
 14. \$1.60.
 15. 86¢.
 16. \$1.65¢.
 17. \$2.95¢.

Page 72

1. \$2.00.
 2. \$30.
 3. \$180.
 4. $\frac{2}{3}$ as much.
 5. \$0.68.
 6. \$3.62.
 7. \$4.50.
 8. \$192.
 9. $272\frac{1}{2}$ sq. ft.
 10. $5\frac{1}{2}$ yd., $27\frac{1}{2}$ yd.
 11. 49 sq. in.
 12. $1\frac{1}{2}$ ft.
 13. \$16,800.
 14. $110\frac{1}{2}$.
 15. 24.
 16. $\frac{2}{3}$.
 17. $\frac{2}{3}$.

Page 75

2. $80\frac{1}{2}$.
 3. $76\frac{1}{2}$.
 4. $71\frac{1}{2}$.
 5. 75¢.
 6. $43\frac{1}{2}$.
 7. $24\frac{1}{2}$.
 9. $18\frac{1}{2}$.
 10. $16\frac{1}{2}$.
 11. $35\frac{1}{2}$.
 12. 40¢.
 13. $28\frac{1}{2}$.
 14. $22\frac{1}{2}$.
 15. $33\frac{1}{2}$.
 16. $8\frac{1}{2}$.
 17. $11\frac{1}{2}$.
 18. $35\frac{1}{2}$.
 19. $10\frac{1}{2}$.
 20. $8\frac{1}{2}$.
 21. $12\frac{1}{2}$.
 22. $14\frac{1}{2}$.
 23. $34\frac{1}{2}$.
 24. 1966¢.
 25. 48 rd. 8 ft.
 26. 59 rd. $1\frac{1}{2}$ ft.

Page 76

1. $1\frac{1}{2}$.
 2. $1\frac{1}{2}$.
 3. $1\frac{1}{2}$.
 4. $1\frac{1}{2}$.
 5. $1\frac{1}{2}$.
 6. $1\frac{1}{2}$.
 7. $1\frac{1}{2}$.
 8. $2\frac{1}{2}$.
 9. $1\frac{1}{2}$.
 10. $\frac{5}{8}$.
 11. $\frac{2}{3}$.
 12. $1\frac{1}{2}$.

13. $12\frac{1}{2}$.14. $3\frac{1}{11}$.

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2. $\frac{7}{8}$.3. $\frac{3}{8}$.4. $\frac{7}{10}$.5. $\frac{1}{2}$.6. $1\frac{1}{2}$.7. $1\frac{1}{10}$.8. $1\frac{1}{10}$.9. $1\frac{1}{10}$.10. $1\frac{1}{10}$.11. $1\frac{1}{10}$.12. $4\frac{1}{2}$.13. $\frac{3}{8}$.14. $2\frac{1}{10}$.15. $1\frac{1}{10}$.16. $2\frac{1}{10}$.17. $\frac{2}{10}$.18. $1\frac{1}{10}$.19. $1\frac{1}{10}$.20. $8\frac{1}{10}$.21. $18\frac{1}{10}$.22. $80\frac{1}{10}$.

23. 48.

24. $1\frac{7}{10}$.25. $3\frac{1}{2}$.26. $1\frac{1}{2}$.27. $2\frac{1}{2}$.28. $1\frac{1}{2}$.29. $7\frac{1}{2}$.30. $5\frac{7}{10}$.

31. 4.

32. 7.

33. $1\frac{1}{2}$.34. $5\frac{1}{2}$.35. $16\frac{1}{2}$.

Page 79

1. 32.

2. 12.

3. $\frac{1}{2}$.4. $11\frac{1}{10}$.

5. 8.

6. $\frac{7}{8}$.7. $\frac{1}{2}$.8. $\frac{1}{2}$.9. $\frac{1}{10}$; $1\frac{1}{10}$.10. $\frac{1}{2}$; $\frac{1}{2}$.

11. 9.

12. $\frac{1}{10}$.13. $10\frac{1}{2}$ hr.14. $7\frac{1}{2}$.15. $1\frac{1}{2}$.

16. 120.

17. $14\frac{1}{10}$.18. $2\frac{1}{2}$.19. $16\frac{1}{10}$.20. $6\frac{1}{10}$.21. $105\frac{1}{10}$.22. $\$49\frac{1}{10}$.

Page 81

1. 53.

2. $13\frac{1}{2}$.

3. 5280.

4. $36\frac{1}{10}$.5. $16\frac{1}{2}$; 66.6. $272\frac{1}{2}$.7. $\$0.81$.8. $\$7.46$.9. $\$19.69$.10. $\$4.43$.11. $\$4.12$.12. $\$2.41$.13. $\$2.74$.14. $\$1.67$.

15. 230 lb.

16. $\frac{7}{10}$ is $\frac{1}{2}$ of $\frac{1}{2}$.17. $\frac{8}{10}$ is $\frac{1}{2}$ of $\frac{1}{2}$.18. $\$46\frac{1}{2}$.19. $284\frac{1}{2}$.20. $20\frac{3}{10}$.21. $\$175$.22. $\$2800$.23. $\$3200$.

Page 83

1. $\$64$.2. $\$64$.3. $\$2560$.4. $\$4720$.5. $\$25$.6. $\frac{1}{2}$, $\frac{1}{2}$, $\frac{1}{2}$, $\frac{1}{2}$.7. $\frac{1}{2}$, $\frac{1}{2}$, $\frac{1}{2}$, $\frac{1}{2}$.8. $\frac{1}{2}$, $\frac{1}{2}$, $\frac{1}{2}$, $\frac{1}{2}$.9. $\frac{1}{2}$, $\frac{1}{2}$, $\frac{1}{2}$, $\frac{1}{2}$.10. $\frac{1}{2}$, $\frac{1}{2}$, $\frac{1}{2}$, $\frac{1}{2}$.11. $\frac{1}{2}$.12. $\frac{1}{2}$.13. $\frac{1}{2}$.14. $\frac{1}{2}$.15. $\frac{1}{2}$.16. $13966\frac{1}{10}$.17. $80\frac{1}{2}$.18. $772\frac{1}{2}$.19. $\frac{1}{10}$.20. $59\frac{1}{2}$.21. $50\frac{1}{10}$.22. $\frac{1}{10}$.23. $\frac{1}{10}$.

24. 20.

25. $\$690$.

26. 150 lb.

Page 85

1. 30.196.

2. 101.218.

3. 101.992.

4. 31.981.

5. 93.47.

6. 17.318.

7. 6.097.

8. 14.386.

9. 20.241.

10. 108.784.

11. 236.669.

12. 8.289.

13. 14.144.

14. 102.687.

15. 230.572.

16. 5.855.

17. 94.398.

18. 222.283.

19. 88.543.

20. 216.428.

21. 17.427.

22. 27.423.

23. 1.452.

24. 2.115.

25. 0.721.

26. 5.083.

27. 1.51.

28. 1.11.

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3. 6.156.

4. 5.52.

5. 20.884.

6. 165.87.

7. 8.366.

8. 3.492.

9. 0.156.

10. 0.855.

11. 1.737.

12. 333.

13. 0.081.

14. 0.512.

15. $\$8.10$.16. $\$200.60$.

17. 129.2.

18. 675 bu.

19. $\$1687.50$.20. $\$1120$.21. $\$520.20$.

ANSWERS

7

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2. 73.204.
3. 1.192.
4. 16.61 T.
5. 46.48 A.
6. 9.8 maple ;
14.7 oak.
7. 104.85 ;
262.125 ;
716.475.

8. 63.
9. \$4080.
10. \$59.34.
11. \$14.25.
12. 0.19.
13. 32%

Page 94

8. 1.068+.
9. 3.2.
10. 213.33+.
11. 24.4375.
12. 38.52.
13. 14.722+.
14. 3.047+.
15. 0.598-.
16. 0.3727+.
17. 1.14 $\frac{1}{2}$.
18. 7.916+.
19. 9.33+.

Page 99

7. \$12.50.
8. \$11.48.
9. \$7.69.

Page 100

1. \$18.56.
2. \$10.27.
3. \$97.75.
4. \$8.03.
5. \$7.37.

6. \$138.50.
7. \$14.96.
8. \$9.24.
9. \$11.19.
10. \$29.26.

Page 101

3. \$20.75.
4. \$2.53.
5. \$11.24.

Page 102

3. 6.
5. 30.
6. $\frac{1}{14}$.
7. 56.
8. $\frac{1}{18}$.
12. 27 $\frac{1}{4}$.
13. 12 $\frac{1}{2}$.
14. 5 $\frac{1}{12}$.
15. 11.
16. 12.
17. 4.

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2. 3 \times 89.
3. 3 \times 3 \times 17.
4. 2 \times 3 \times 3 \times 7 \times 7.
5. 3 \times 3 \times 103.
6. 5 \times 31.
7. 5 \times 3 \times 3 \times 7.
8. 5 \times 3 \times 3 \times 11.
9. 2 \times 2 \times 131.
10. 2 \times 2 \times 3 \times 3 \times 3 \times 53.
11. 5 \times 5 \times 5 \times 3.
12. 3 \times 3 \times 671.
13. 2 \times 3 \times 3 \times 13.
14. 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 3.

15. 2 \times 2 \times 3 \times 3 \times 3 \times 3 \times 3.
16. 2 \times 3 \times 3 \times 3 \times 19.
17. 3 \times 3 \times 103.
20. 5 \times 3 \times 7.
21. 107 \times 1.
22. 3 \times 29.
23. 2 \times 47.
24. 2 \times 103.
25. 307 \times 1.
26. 13 \times 23.
27. 349 \times 1.
28. 3 \times 3 \times 23.
29. 3 \times 3 \times 2 \times 17.
30. 7 \times 103.
31. 2 \times 3 \times 3 \times 47.
32. 1243 \times 1.
33. 487 \times 1.
34. 2 \times 2 \times 71.
35. 2 \times 253.

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7. 192 cu. yd.
8. 30 cu. ft.
9. 36 cu. in.
10. 64 cu. in.
11. 60.
12. 64.
13. 288 cu. yd.
14. \$36.

Page 109

1. 16 cu. in.
6. 78 sq. ft.
7. 72 sq. in.
10. 240 cu. in.
11. 248 sq. in.

Page 110

1. 587.
2. 13.

3. 12.
4. 5877.
5. 391 pk.
6. 145 $\frac{1}{2}$ bu.
7. 104 ft.
8. 4 da.
9. 9 men.
10. \$6215.
11. \$5940.
12. 1008 sq. ft.
13. \$933.50.
14. 252 sq. ft.
15. \$54.75.

Page 111

1. 184 qt.
2. 175 qt.
3. \$248.50.
4. \$68.07.
5. \$10,500.
6. 542.
7. \$3840.
8. \$3060.
9. \$3992.
10. 2011.
11. 13104.
12. 228.
13. 1700.
14. 180 sq. ft.
15. \$75.60.
16. \$22.79.

Page 112

1. \$45.
2. \$24.
3. 54 bu.
4. \$171.62.
5. 632.
6. 9200.
7. 1026.
8. \$1000.

9. \$180.
10. 16 qt.
11. 20 in.; 22 in.
12. 72 in.; 36 in.
13. 92¢.
14. \$1.60.
15. 1296.
16. \$5040.
17. $40\frac{1}{2}$.

Page 113

1. \$3565.80.
2. \$476.78.
3. \$1109.
4. 305 in.
5. 193.
6. $\frac{1}{3}$; $\frac{1}{4}$; $\frac{1}{4}$; $\frac{1}{2}$.
7. 366.
8. 1056 bu.
9. \$1568.
10. 85 ft.
11. 80 sq. in.
12. 96 sq. ft.
13. 9 sq. ft.; 144 sq. ft.
14. \$135.66.
15. \$18.48.
16. 88 qt.

Page 114

1. 8 hr.
2. \$4950.
3. 112 sq. ft.
4. 80 lb.
5. 14 sq. in.
7. 118.

8. $2 \times 19, 2 \times 13,$
 $3 \times 13,$
 $2 \times 3 \times 7,$
 $2 \times 2 \times 2 \times 7,$
 $3 \times 3 \times 7,$
 $5 \times 5 \times 3.$
9. 4 da.; 3 da.
10. 1166.
11. 295.
12. 219 oz.
13. \$1240.
14. \$180.
15. $28\frac{1}{2}$ ft.
16. 214 in.

Page 115

1. $\frac{2}{3}, \frac{4}{5}.$
2. $\frac{3}{8}, \frac{1}{5}.$
3. $\frac{1}{6}, \frac{1}{4}.$
4. $\frac{1}{5}, \frac{2}{15}.$
5. $\frac{3}{8}, \frac{1}{15}.$
6. $\frac{2}{3}, 63\frac{2}{3}.$
7. $\frac{22}{5}, 65\frac{4}{5}.$
8. $\frac{43}{15}, 62\frac{1}{3}.$
9. $21\frac{2}{7}, 32\frac{3}{10}.$
10. $\frac{26}{5}, 1\frac{1}{2}.$

11. $\begin{cases} 2 \times 3 \times 2 \times 2 \times 5 \times 5 \\ 3 \times 3 \times 2 \times 2 \times 2 \times 5 \end{cases}$
12. $\begin{cases} 2 \times 3 \times 2 \times 2 \times 2 \times 7 \\ 2 \times 2 \times 3 \times 37. \end{cases}$
13. $\begin{cases} 2 \times 5 \times 3 \times 3 \times 3 \times 3 \\ 5 \times 3 \times 3 \times 17. \end{cases}$
14. $\begin{cases} 5 \times 5 \times 3 \times 7 \\ 5 \times 5 \times 2 \times 2 \times 3 \times 3 \times 2 \times 2. \end{cases}$
15. $\begin{cases} 3 \times 2 \times 2 \times 3 \times 11 \\ 2 \times 2 \times 3 \times 2 \times 3 \times 2 \times 11. \end{cases}$

16. 52.
17. $1\frac{1}{2}.$
18. $2\frac{1}{2}.$
19. $163\frac{1}{3}.$
20. 510.
21. $31\frac{1}{2}.$
22. $55\frac{1}{2}.$
23. $21\frac{1}{16}.$
24. $2\frac{1}{16}.$
25. $29\frac{5}{100}.$
26. $61\frac{1}{2}.$
27. $21\frac{1}{2}.$
28. $62\frac{1}{10} -.$
29. $110\frac{2}{3}.$
30. 8.963.
31. $117\frac{1}{2}.$
32. 315.
33. 656.
34. $\frac{2}{3}.$
35. $\frac{1}{2}.$
36. 160.
37. $91\frac{1}{3}.$
38. $\frac{3}{5}.$
39. $\frac{4}{5}.$
40. $1\frac{1}{5}.$

Page 116

1. \$4015.
2. 27 ft.
3. 24 yd.
4. $24\frac{2}{3}.$
5. \$15.
6. 52 lb.; 4 lb.
7. 150 ft.
8. \$5.04.
9. \$2500.
10. 340 bu.
11. \$6140.
12. 340 acres.
13. 136 trees.
14. 342 bu.
15. $2^8 \times 3^8 \times 5.$

Page 117

1. $411\frac{1}{2}.$
2. $45\frac{1}{10}.$
3. $38\frac{4}{10}.$
4. $1067\frac{1}{10}.$
5. $56\frac{3}{10}.$
6. $79\frac{4}{10}.$
7. $57\frac{1}{10}.$
8. 22¢.
9. 7 ch. 75¢ left.
10. $437\frac{1}{2}$ mi.
11. \$760.
12. $\frac{2}{3}$ of a ft.
13. $\frac{1}{3}$ (using 30 da.)
14. 32 da.
15. \$1.30.
16. \$225.00.
17. \$18.00.

ANSWERS

SECOND BOOK—PART II

Page 125

1. 9958.
2. 28,338.
3. 28,157.
4. 28,156.
5. 19,943.
6. 16,512.

Columns.

- a. 20,262.
- b. 38,527.
- c. 40,396.
- d. 31,879.
7. 131,064.
8. 572.
9. 1956.
10. 84.
11. 84.
12. 170.
13. 161.
14. 304.
15. 146.
16. 2696.
17. 2696.
18. 781.
20. 6790.
21. 168.
22. 584.
23. 9169.
24. 17,622.
25. 146,236.
26. 16,535.

27. 30,307.
28. 261,704.

Page 131

1. 130,248.
2. 407,391.
3. 743,184.
4. 310,362.
5. 566,955.
6. 357,048.
7. 838,847.
8. 649,044.
9. 756,504.
10. 579,712.
11. \$3578.25.
12. \$4445.65.
13. \$670.02.
14. \$10,364.53.
15. \$178.89 $\frac{1}{2}$.
16. \$78.05.
17. \$633.55 $\frac{1}{2}$.
18. \$280.02 $\frac{3}{4}$.
19. 1243; rem. 18.
20. 1282; rem. 6.
21. 1111; rem. 46.
22. 544; rem. 15.
23. 1292; rem. 25.
24. 294; rem. 20.
25. 1038; rem. 65.
26. 249; rem. 41.
27. 810; rem. 19.
28. 657; rem. 21.

29. 2650; rem. 26.
30. 4108; rem. 10.
31. 1038; rem. 22.
32. 1369; rem. 13.
33. 1396; rem. 15.
34. 3359; rem. 110.
35. 3754; rem. 137.
36. 655; rem. 92.
37. 724; rem. 94.
38. 748; rem. 433.
39. 336; rem. 348.
40. \$5.67.
41. \$2.17.
42. \$1.05.
- 43.
44. \$22.15.
45. \$.29.
46. \$31.90.
47. 67; rem. 40.
48. 5489;
rem. 198.
49. \$260;
rem. \$1188.
50. \$877;
rem. \$482.
51. \$318;
rem. \$1729.
52. 274; rem. 716.
53. \$488;
rem. \$624.
54. 2856;
rem. 211.

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Addition.

1. 59,881.
2. 539,382.
3. 5,570,546.
4. 70,628.
5. 661,464.
6. 6,956,973.
7. 80,834.
8. 757,216.
9. 8,351,320.
10. 102,485.
11. 915,666.
12. 9,749,326.
13. 94,937.
14. 917,943.
15. 9,749,066.
16. 170,927.
17. 1,609,125.
18. 16,461,548.
19. 4,163,226.
20. 5,396,560.
21. 5,410,290.
22. 6,147,249.
23. 7,517,239.
24. 6,888,589.
25. 4,704,914.
26. 7,609,670.
27. 5,597,529.
28. 4,661,840.
29. 54.

a. 153,264.
b. 358,783.
c. 979,737.
d. 344,518.
e. 797,892.
f. 713,236.
g. 751,820.
h. 606,345.
i. 923,814.
j. 548,479.
k. 473,235.
l. 832,748.
m. 726,236.
n. 724,930.
o. 1,094,675.
p. 745,317.
q. 1,058,727.
r. 951,103.
s. 676,213.
t. 484,432.
u. 650,523.
v. 424,606.
w. 1,039,644.
x. 406,887.
y. 1,007,684.
z. 788,414.

Subtraction.

1.
a. 45,423.
b. 11,924.
c. 20,892.
d. 67,048.
e. 51,690.
f. 64,369.
g. 12,681.
h. 38,205.
i. 79,732.
j. 87,537.
k. 83,771.
l. 61,745.

m. 23,168.
n. 43,961.
o. 91,964.
p. 38,896.
q. 50,353.
r. 82,015.
s. 8144.
t. 91,195.
u. 67,207.
v. 63,836.
w. 47,602.
x. 89,429.
y. 70,821.
z. 44,590.
2.
a. 58,108.
b. 325,583.
c. 925,305.
d. 197,166.
e. 668,698.
f. 556,469.
g. 705,508.
h. 500,393.
i. 742,813.
j. 351,101.
k. 288,634.
l. 698,965.

m. 660,437.
n. 621,750.
o. 890,479.
p. 639,694.
q. 937,861.
r. 757,898.
s. 632,555.
t. 290,050.
u. 495,558.
v. 278,166.
w. 921,403.
x. 200,627.
y. 838,147.
z. 669,035.

3.

a. 1424.
b. 1107.
c. 369.
d. 4102.
e. 691.
f. 2333.
g. 2772.
h. 263.
i. 397.
j. 1771.
k. 2373.
l. 3204.
m. 1511.
n. 1645.
o. 2546.
p. 2499.
q. 2984.
r. 684.
s. 5101.
t. 2804.
u. 520.
v. 1427.
w. 1528.
x. 81.
y. 55.

4.

a. 32,075.
b. 10,075.
c. 46,525.
d. 11,256.
e. 13,370.
f. 54,021.
g. 28,296.
h. 38,891.
i. 8202.
j. 5537.
k. 24,399.
l. 35,373.
m. 19,282.
n. 49,648.

o. 50,522.
p. 8958.
q. 34,046.
r. 74,555.
s. 77,950.
t. 21,184.
u. 3891.
v. 14,807.
w. 43,355.
x. 18,527.
y. 25,386.
5.

a. 235,400.
b. 609,797.
c. 681,594.
d. 460,256.
e. 98,860.
f. 95,018.
g. 176,819.
h. 281,311.
i. 383,510.
j. 68,004.
k. 385,932.
l. 73,901.

m. 19,405.
n. 318,377.
o. 301,307.
p. 307,125.
q. 145,317.
r. 199,898.
s. 264,555.
t. 184,324.
u. 221,283.
v. 628,430.
w. 677,421.
x. 618,993.
y. 194,498.

Multiplication.

1.
a. 1638.
b. 20,160.

- c. 31,213.
d. 4800.
e. 24,300.
f. 15,066.
g. 10,880.
h. 29,568.
i. 21,280.
j. 17,640.
k. 18,792.
l. 82,180.
m. 8640.
n. 33,642.
o. 31,568.
p. 7500.
q. 28,350.
r. 51,744.
s. 12,312.
t. 77,220.
u. 92,400.
v. 81,282.
w. 109,446.
x. 38,157.
y. 49,248.
z. 87,234.
2.
a. 264,965.
b. 2,569,632.
c. 3,382,748.
d. 1,770,165.
e. 5,443,244.
f. 6,914,070.
g. 4,954,995.
h. 9,325,368.
i. 5,876,419.
j. 3,524,906.
k. 2,892,043.
l. 2,608,242.
m. 2,947,464.
n. 3,623,759.
o. 5,377,152.
p. 7,119,554.
- q. 3,764,299.
r. 5,952,227.
s. 8,111,796.
t. 2,890,708.
u. 6,073,634.
v. 4,316,488.
w. 5,113,188.
x. 4,422,832.
y. 6,649,522.
z. 4,882,128.
3.
a. 9,213,206.
b. 13,635,104.
c. 21,622,464.
d. 29,729,181.
e. 39,144,124.
f. 56,156,355.
g. 14,326,254.
h. 46,219,098.
i. 74,366,207.
j. 46,155,425.
k. 47,206,902.
l. 54,659,377.
m. 13,790,088.
n. 36,902,236.
o. 82,259,056.
p. 37,964,082.
q. 33,019,392.
r. 57,539,662.
s. 15,636,852.
t. 74,570,178.
u. 69,046,593.
v. 50,533,752.
w. 38,053,772.
x. 48,779,616.
y. 58,986,241.
z. 26,998,768.
4.
a. 62,902,960.
b. 40,674,917.
c. 96,000,768.
- d. 302,638,785.
e. 501,128,839.
f. 663,452,466.
g. 129,983,130.
h. 451,882,314.
i. 592,245,893.
j. 685,981,450.
k. 487,864,146.
l. 200,611,866.
m. 185,576,868.
n. 233,356,676.
o. 632,883,072.
p. 429,812,772.
q. 368,214,528.
r. 865,656,314.
s. 148,567,017.
t. 348,942,894.
u. 477,652,098.
v. 416,135,676.
w. 406,328,499.
x. 878,951,282.
y. 718,211,362.
z. 535,784,019.
5.
a. 4,904,840,768.
b. 4,999,675,268.
c. 23,531,408,064.
d. 19,140,663,347.
e. 43,751,063,195.
f. 46,237,307,532.
g. 14,052,855,084.
h. 26,133,312,150.
i. 71,802,434,178.
j. 42,257,897,900.
k. 33,720,541,536.
l. 49,524,287,556.
m. 20,328,681,798.
n. 32,685,436,504.
o. 97,301,344,500.
p. 32,916,630,432.
q. 56,530,392,576.
- r. 77,699,217,728.
s. 10,991,116,194.
t. 3,646,375,579.
u. 41,947,242,183.
v. 24,287,191,272.
w. 53,692,882,454.
x. 29,402,798,658.
y. 73,271,128,154.
z. 39,380,533,644.
Division.
1.
a. 52,438.
b. 37,808; rem. 4.
c. 135,724;
rem. 5.
d. 53,695; rem. 4.
e. 72,873; rem. 5.
f. 209,958;
rem. 2.
g. 90,611; rem. 6.
h. 49,825.
i. 207,346;
rem. 2.
j. 37,156; rem. 4.
k. 62,978; rem. 4.
l. 50,920; rem. 4.
m. 137,980;
rem. 3.
n. 74,499; rem. 7.
o. 123,609;
rem. 3.
p. 171,892.
q. 142,099.
r. 77,216.
s. 108,246;
rem. 2.
t. 29,609; rem. 6.
u. 35,577;
rem. 15.
v. 18,313;
rem. 17.

- w. 57,434;
 rem. 16.
 x. 42,710; rem. 3.
 y. 101,996;
 rem. 2.
 z. 51,676; rem. 4.
 2.
 a. 20; rem. 55.
 b. 34; rem. 49.
 c. 42; rem. 54.
 d. 66; rem. 21.
 e. 103; rem. 4.
 f. 96; rem. 90.
 g. 98; rem. 41.
 h. 112; rem. 69.
 i. 72; rem. 1.
 j. 103; rem. 28.
 k. 62; rem. 73.
 l. 32; rem. 22.
 m. 87; rem. 34.
 n. 53; rem. 70.
 o. 93; rem. 15.
 p. 119; rem. 53.
 q. 71; rem. 89.
 r. 96; rem. 55.
 s. 115; rem. 39.
 t. 37; rem. 15.
 u. 84; rem. 14.
 v. 64; rem. 10.
 w. 84; rem. 81.
 x. 112; rem. 69.
 y. 93; rem. 70.
 z. 146; rem. 61.
 3.
 a. 237; rem. 79.
 b. 15; rem. 773.
 c. 28; rem. 224.
 d. 170; rem. 403.
 e. 92; rem. 53.
 f. 95; rem. 732.
 g. 26; rem. 172.
 h. 48; rem. 450.
 i. 100; rem. 673.
 j. 194; rem. 297.
 k. 168; rem. 366.
 l. 76; rem. 771.
 m. 62; rem. 450.
 n. 64; rem. 300.
 o. 117; rem. 584.
 p. 60; rem. 294.
 q. 97; rem. 475.
 r. 145; rem. 273.
 s. 18; rem. 291.
 t. 120; rem. 553.
 u. 78; rem. 603.
 v. 96; rem. 304.
 w. 79; rem. 323.
 x. 198; rem. 138.
 y. 108; rem. 7.
 z. 109; rem. 369.
 4.
 a. 77; rem. 1311.
 b. 122; rem. 2458.
 c. 245; rem. 453.
 d. 63; rem. 1044.
 e. 87; rem. 2546.
 f. 69; rem. 6254.
 g. 108; rem. 754.
 h. 57; rem. 7886.
 i. 121; rem. 1625.
 j. 61; rem. 4358.
 k. 69; rem. 649.
 l. 246; rem. 2680.
 m. 109; rem. 3421.
 n. 140; rem. 318.
 o. 153;
 rem. 4779.
 p. 76; rem. 5240.
 q. 153;
 rem. 3406.
 r. 89; rem. 7169.
 s. 73; rem. 8611.
 t. 104;
 rem. 2411.
 u. 87; rem. 5313.
 v. 58; rem. 2168.
 w. 132;
 rem. 1036.
 x. 133;
 rem. 4712.
 y. 102; rem. 170.
 z. 73; rem. 4929.
Page 134
 1. 153 in.
 2. 46 pt.; 127 pt.
 3. 23 pk.
 4. 23 ft.; 29 ft.;
 41 ft.
 5. 240 in.; 280 in.
 6. 234 gal.;
 222 gal.
 7. 125 yd.;
 123 yd.
 8. 396 oz.
 9. 11,675 lb.
 10. 86,400 sec.;
 313,200 sec.
 11. 744 hr.
 12. 52 pkgs.
 13. 2400 pt.
 14. 1132 steps.
 15. 1475 yd.
 16. 60 cents.
 17. 23½ gal.;
 \$4.19.
 18. 240 rd.
 19. 109 yd. 22 in.
 20. 412 oz.
 21. \$415.68.
Page 138
 4. 9; 1½.
 5. 48; 1½.
 6. 5; 1½.
 7. 21; 1½.
 8. 42; 1½.
 9. 49; 1½.
 10. 72; 1½.
 11. 25; 1½.
 12. 25; 1½.
 13. 52; 1½.
 14. 24; 1½.
 15. 16; 1½.
 16. 9; 1½.
 17. 18; 1½.
 18. 42; 1½.
 19. 21; 1½.
 20. 144; 1½; 144; 144;
 144;
 21. 144; 144; 144; 144;
 22. 144; 144;
 23. 144;
 24. 144;
 25. 144;
Page 139
 12. 144;
 13. 144;
 14. 144;
 15. 144;
 16. 144;
 17. 144;
 18. 144;
Page 143
 8. 1½.
 9. 1½.
 10. 1½.
 11. 2½.
 12. 2½.
 13. 1½.
 14. 1½.
 15. 1½.
 16. 3½.

17. $\frac{1}{2}$.
 18. $\frac{1}{2}$.
 19. $\frac{1}{2}$, $\frac{1}{2}$, $\frac{1}{2}$.
 20. $\frac{1}{2}$, $\frac{1}{2}$.
 21. $\frac{1}{2}$, $\frac{1}{2}$, $\frac{1}{2}$, $\frac{1}{2}$.
 22. 12, 24, 30, 60.
 23. 16, 24, 52, 80.
 24. 8, 20, 40, 60.

Page 144

1. $\frac{1}{2}$, $\frac{1}{2}$.
 2. $\frac{1}{2}$, $\frac{1}{2}$.
 3. $\frac{1}{2}$, $\frac{1}{2}$.
 4. $\frac{1}{2}$, $\frac{1}{2}$.
 5. $\frac{1}{2}$, $\frac{1}{2}$.
 6. $\frac{1}{2}$, $\frac{1}{2}$.
 7. $\frac{1}{2}$, $\frac{1}{2}$.
 8. $\frac{1}{2}$, $\frac{1}{2}$.
 9. $\frac{1}{2}$, $\frac{1}{2}$.
 10. $\frac{1}{2}$, $\frac{1}{2}$.
 11. $\frac{1}{2}$, $\frac{1}{2}$.
 12. $\frac{1}{2}$, $\frac{1}{2}$.
 13. $\frac{1}{2}$, $\frac{1}{2}$.
 14. $\frac{1}{2}$, $\frac{1}{2}$.
 15. $\frac{1}{2}$, $\frac{1}{2}$.
 16. $\frac{1}{2}$, $\frac{1}{2}$.
 17. $\frac{1}{2}$, $\frac{1}{2}$.
 18. $\frac{1}{2}$, $\frac{1}{2}$.
 19. $\frac{1}{2}$, $\frac{1}{2}$.
 20. $\frac{1}{2}$, $\frac{1}{2}$.
 21. $\frac{1}{2}$, $\frac{1}{2}$.
 22. $\frac{1}{2}$, $\frac{1}{2}$.
 23. $\frac{1}{2}$, $\frac{1}{2}$.
 24. $\frac{1}{2}$, $\frac{1}{2}$.
 25. $\frac{1}{2}$, $\frac{1}{2}$.
 26. $\frac{1}{2}$, $\frac{1}{2}$.
 27. $\frac{1}{2}$, $\frac{1}{2}$.
 28. $\frac{1}{2}$, $\frac{1}{2}$.
 29. $\frac{1}{2}$, $\frac{1}{2}$.
 30. $\frac{1}{2}$, $\frac{1}{2}$.
 31. $\frac{1}{2}$, $\frac{1}{2}$.

- 32.
- $10\frac{1}{2}$
- .

33. 6.

- 34.
- $\frac{1}{2}$
- .

- 35.
- $\frac{1}{2}$
- .

- 36.
- $\frac{1}{2}$
- .

- 37.
- $\frac{1}{2}$
- .

Page 146

1. $\frac{1}{2}$; \$1.50.
 2. $\frac{1}{2}$; 15¢.
 3. 30¢.
 4. $\frac{1}{2}$, \$16.
 5. 4; \$4800.
 6. $\frac{1}{2}$; 27.
 7. $\frac{1}{2}$; \$21.
 8. $\frac{1}{2}$; 248.
 9. $\frac{1}{2}$; \$12.
 10. \$1200.
 11. $\frac{1}{2}$; \$1.20.
 12. \$5.00.
 13. 6500 ft.

Page 149

5. 48 mi.
 6. 12 mi.
 7. \$24.
 8. \$1800.
 9. \$2.25;
 \$6.75; \$11.25;
 \$18.
 10. 20.
 11. $\frac{1}{2}$.
 12. $\frac{1}{2}$.
 13. $\frac{1}{2}$.
 14. \$8000.

Page 152

11. $\frac{1}{2}$.
 12. $\frac{1}{2}$.
 13. $\frac{1}{2}$.
 14. $\frac{1}{2}$.

15. $\frac{1}{2}$.
 16. $\frac{1}{2}$.
 17. $\frac{1}{2}$.
 18. $\frac{1}{2}$.
 19. $\frac{1}{2}$.
 20. $\frac{1}{2}$.
 141. $328\frac{1}{2}$.
 142. $465\frac{1}{2}$.
 143. $367\frac{1}{2}$.
 144. $490\frac{1}{2}$.
 145. $253\frac{1}{2}$.
 146. $234\frac{1}{2}$.
 147. $272\frac{1}{2}$.
 148. $326\frac{1}{2}$.
 149. $619\frac{1}{2}$.
 150. $152\frac{1}{2}$.
 151. $868\frac{1}{2}$.
 152. $440\frac{1}{2}$.
 153. $554\frac{1}{2}$.
 154. $570\frac{1}{2}$.
 155. $839\frac{1}{2}$.
 156. $339\frac{1}{2}$.
 157. $475\frac{1}{2}$.
 158. $449\frac{1}{2}$.
 159. $658\frac{1}{2}$.
 160. $873\frac{1}{2}$.
 161. $321\frac{1}{2}$.
 162. $463\frac{1}{2}$.
 163. $369\frac{1}{2}$.
 164. $497\frac{1}{2}$.
 165. $262\frac{1}{2}$.
 166. $230\frac{1}{2}$.
 167. $279\frac{1}{2}$.
 168. $337\frac{1}{2}$.
 169. $633\frac{1}{2}$.
 170. $166\frac{1}{2}$.
 171. $877\frac{1}{2}$.
 172. $460\frac{1}{2}$.
 173. $575\frac{1}{2}$.
 174. $538\frac{1}{2}$.
 175. $765\frac{1}{2}$.

176. $278\frac{1}{2}$.
 177. $410\frac{1}{2}$.
 178. $456\frac{1}{2}$.
 179. $648\frac{1}{2}$.
 180. $912\frac{1}{2}$.
 181. $54\frac{1}{2}$.
 182. $112\frac{1}{2}$.
 183. $165\frac{1}{2}$.
 184. $231\frac{1}{2}$.
 185. $285\frac{1}{2}$.
 186. $360\frac{1}{2}$.
 187. $300\frac{1}{2}$.
 188. $433\frac{1}{2}$.
 189. 650 .
 190. $791\frac{1}{2}$.
 191. $888\frac{1}{2}$.
 192. $427\frac{1}{2}$.
 193. $221\frac{1}{2}$.
 194. $131\frac{1}{2}$.
 195. $9\frac{1}{2}$.
 196. $30\frac{1}{2}$.
 197. $71\frac{1}{2}$.
 198. $809\frac{1}{2}$.
 199. $464\frac{1}{2}$.
 200. $553\frac{1}{2}$.
 201. $4\frac{1}{2}$.
 202. $27\frac{1}{2}$.
 203. $1\frac{1}{2}$.
 204. $3\frac{1}{2}$.
 205. $2\frac{1}{2}$.
 206. $4\frac{1}{2}$.
 207. $5\frac{1}{2}$.
 208. $5\frac{1}{2}$.
 209. $4\frac{1}{2}$.
 210. $4\frac{1}{2}$.
 211. $4\frac{1}{2}$.
 212. $12\frac{1}{2}$.
 213. $26\frac{1}{2}$.
 214. $22\frac{1}{2}$.
 215. $54\frac{1}{2}$.
 216. $18\frac{1}{2}$.

217. $11\frac{2}{11}$.
 218. $9\frac{27}{155}$.
 219. $15\frac{33}{155}$.
 220. $5\frac{13}{155}$.
 221. $1\frac{1}{155}$.
 222. $1\frac{1}{155}$.
 223. $\frac{5}{155}$.
 224. $\frac{17}{155}$.
 225. $1\frac{107}{155}$.
 226. $1\frac{111}{155}$.
 227. $\frac{21}{155}$.
 228. $\frac{231}{155}$.
 229. $\frac{14}{155}$.
 230. $\frac{11}{155}$.
 231. $\frac{173}{155}$.
 232. $\frac{11}{155}$.
 233. $\frac{19}{155}$.
 234. $\frac{22}{155}$.
 235. $1\frac{23}{155}$.
 236. $\frac{25}{155}$.
 237. $5\frac{173}{155}$.
 238. $3\frac{1}{155}$.
 239. $\frac{23}{155}$.
 240. $\frac{21}{155}$.

Page 155

1. \$15.798.
 2. \$2.525.
 3. \$11.285.
 4. \$29.97.
 5. \$42.735.
 6. \$16.479.
 7. \$12.14.
 8. \$6.639.
 9. \$1.285.
 10. \$4.072.
 11. \$4.667.
 12. \$5.622.
 13. \$24.221.
 14. \$2.315;
 \$3.615.

15. \$2.014.
 16. \$53.90.
 17. \$59.8.
 18. \$52.445.
 19. \$26.875.
 20. \$16.128.
 21. \$7.20.
 22. \$101.178.
 23. \$572.30.
 24. \$57.23.
 25. \$5.723.

Page 159

1. 48.634.
 2. .0254.
 3. 93.182.
 4. 421.109.
 5. 20.194.
 6. 441.735.
 7. 4.2103.
 8. 1.0459.
 9. 20.9713.
 10. 16.6008.
 11. .51663.
 12. 8.995 tons.
 13. 18.525 acres.
 14. 2.647.
 15. .505.
 16. 6.8.
 17. 17.7552.
 18. 5.3076.
 19. 20.6159.
 20. 78.655.
 21. 82.3637.

Page 165

2. 9.75.
 3. 408.6.
 4. 241.8.
 5. 3.36.
 6. 8.856.

7. \$31.82.
 8. 37.746.
 9. 69.0346.
 10. 9.3411.
 11. .0115.
 12. .30668.
 13. 1.18296.
 14. 78.125.
 15. .2091.
 16. 2.1912.
 17. .7676.
 18. 3.15.
 19. .533.
 20. \$1350.
 21. \$110.
 22. \$4463.46.
 23. 73.98 A.
 24. \$1893.89.
 25. \$640 gain;
 \$3840 selling
 price.

Page 166

1. $\frac{1}{2}$.
 2. \$0.80.
 3. $1\frac{1}{2}$ in.
 4. $8\frac{1}{2}$ in.
 5. 7 ft. 5 in.
 6. 1289.52 cu. ft.
 7. $\frac{1}{2}$.
 8. $\frac{3}{4}$.
 9. $\frac{3}{4}$.
 10. $\frac{1}{2}$.
 11. $\frac{173}{155}$.
 12. $\frac{31}{155}$.
 13. $\frac{27}{155}$.
 14. $\frac{22}{155}$.
 15. $\frac{1}{2}$.
 16. $\frac{26}{155}$.
 17. $\frac{3}{155}$.
 18. $\frac{23}{155}$.

19. \$103.52.
 20. \$234.57.
 21. 32 acres.
 22. \$79.80.
 23. .21084.
 24. .04592.
 25. .2432.
 26. .00064.
 27. .99004.
 28. .326326.
 29. .04.
 30. .0387.
 31. 3.3136.
 32. .022454.
 33. .000152.
 34. 8.26281.

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1. $\frac{1}{2}$.
 2. 36.75 yd.
 3. 137.915.
 4. 26.842.
 5. 89.423.
 6. 16.686.
 7. 84.285.
 8. .15.
 9. .49.
 10. .582.
 11. .165.
 12. 1.573.
 13. 1.857.
 14. 2.0254.
 15. .9403.
 16. .097.
 17. 1.155.
 18. \$16.417.
 19. \$42.78.
 20. \$28.13.
 21. 375 girls.
 22. \$26.29.
 23. .4383.

Page 169

1. 10.8.
2. 24.
3. 8.2.
4. .07.
5. .24.
6. 80.
7. 5000.
8. .6.
9. 12.
10. 1200.
11. 5000.
12. 25.
13. 1.2.
14. 1.2.
16. 16.625.
17. 51.2.
18. 2.56.
19. 12.
20. .5.
21. 3.6.
22. .06.
23. 35.
24. 4.
25. .20 +.
26. 54.
27. 60.
28. 70.
29. 160.
30. 9.
31. 68.59 T.

Page 170

3. .25.
4. .125.
5. .875.
6. .0833 +.
7. .0625.
8. .12.
9. .35.
10. .4375.

11. .6.
12. .9375.
13. .68.
14. .5625.
15. .76.
16. .53125.
17. .6875.
18. .36.
20. .66 $\frac{2}{3}$.
21. .16 $\frac{2}{3}$.
22. .28 $\frac{1}{3}$.
23. .41 $\frac{1}{3}$.
24. .58 $\frac{1}{3}$.
25. .44 $\frac{1}{3}$.
26. .15 $\frac{1}{3}$.
27. .71 $\frac{1}{3}$.
28. .46 $\frac{2}{3}$.
29. .91 $\frac{1}{3}$.
30. .17 $\frac{1}{3}$.
31. .45 $\frac{1}{3}$.
33. 5.34375.
34. 3.8125.
35. 9.432.
36. 4.95.
37. 13.875.
38. 7.30 $\frac{1}{3}$.
39. 6.48 $\frac{2}{3}$.
40. 17.66 $\frac{2}{3}$.
41. 19.45 $\frac{5}{11}$.
42. 2.1955.

Page 171

1. 6.206.
2. 67.1875 A. or
0.261+ of
the farm.
3. 45.
4. 10.125.
5. $4\frac{1}{2} = \frac{1}{2}$ of $22\frac{1}{2}$.
6. 4.65.
7. 4500 bu.

8. 4800 yd.
9. 5.21 $\frac{1}{4}$.
10. 1.07.
11. \$3.60.
12. 34 T.
13. 160 mi.
14. 24.5 yd.
15. 4000.
16. \$5004.
17. \$57.60.
18. \$1.44.
19. .75.

Page 173

1. \$9.96.
2. \$1206.
3. \$5000.
4. \$46.
5. $\frac{1}{2}$; 0.2; 20%.
6. \$92.
7. \$210.
8. \$210.
9. \$320.
10. \$410.
11. \$442.
12. \$8.699 +.
13. \$.045.
14. \$.054.
15. \$23; $2\frac{3}{10}$; 23%.
16. \$.14.

Page 174

17. \$16.50.
18. $25\frac{1}{2}$ yd.
19. 232 pkgs.
20. 7.68.
21. \$8.19.
22. \$.78.
23. $43\frac{1}{2}\%$.
24. 72 rd. 12 ft.
25. \$40.

26. 77.868 A.
27. .35 $\frac{1}{4}$.
28. .428 $\frac{1}{4}$.
29. 712.882 +.
30. 118.1013.
31. 59.817.

Page 177

2. 782 bu.
3. 5699.4 yd.
4. \$274.80.
5. 97.44 bu.
6. 261.1 T.
7. \$5400.
8. 18,602.
9. \$230.
10. \$1391.52.
11. 1120 sheep.
12. 700 sheep.

Page 178

1. \$3.50.
2. 4900 lb.
3. \$81.
4. 68 T.
5. \$256.50.
6. \$211.20.
7. \$98.
8. \$351.90.
9. \$133.10.
10. 728 sheep.
11. $\frac{4}{5}$, 80%.

Page 180

1. $12\frac{1}{2}\%$.
2. $\frac{1}{10}$, 10%.
3. 25%.
4. $33\frac{1}{3}\%$.
5. 88%.
6. $86\frac{2}{3}\%$.
7. $45\frac{1}{5}\%$.

9. $5\frac{1}{2}\%$
 10. \$4953.
 11. \$3387.43.
 12. 25%

Page 182

1. $37\frac{1}{2}\% = \frac{3}{8}$ of 100%
 3. $16\frac{2}{3}\% = \frac{1}{3}$ of 100%
 \$108.
 4. \$24.
 5. 1520 acres.
 6. \$2000.
 7. \$54.
 8. 500 bu.
 9. \$120.
 10. \$20.
 11. \$400.
 12. \$128.
 13. $62\frac{1}{2}\% = \frac{5}{8}$ of 100%;
 1200 bu.
 14. 384 sheep.
 15. 3.

$18\frac{3}{4}\% = \frac{3}{8}$ of 100%;
 1280 bu.

Page 184

1. \$75.60; 67.5 lb.; 147.6 ft.
 2. 78 T.; 164.16 mi.; 414 men.
 3. \$767.25.
 4. \$3900.
 5. 1225 bu.
 6. \$700.
 7. 3200.
 8. \$4; 800 ft.
 9. \$150.

10. $12\frac{1}{2}\%$
 11. $\frac{1}{3}$, 20%
 12. 4%
 13. \$17.
 14. \$30.
 15. 12%
 16. \$85.

Page 186

1. \$72.80.
 2. \$255; $14\frac{2}{3}\%$
 3. 75%
 4. 20%
 5. $66\frac{2}{3}\%$
 6. 20%
 7. \$180.
 8. 20%
 9. \$9.375.
 10. 20%
 11. \$150.
 12. \$302.94.
 13. \$30473.56
 14. $16\frac{2}{3}\%$
 15. 320 sheep.

Page 187

1. \$448.
 2. 20%
 3. \$8250.
 4. $31\frac{1}{3}\%$
 5. \$4375.
 6. 730 bbl.
 7. 422.3 T.
 8. 239.1 lb.
 9. \$3393.72.
 10. 629.34 mi.
 11. \$3847.185.
 12. 493.8.
 13. 28%
 14. 64%
 15. 23%

16. 38.999 + %
 17. 22%
 18. 8.434 + %
 19. 17%
 20. $16\frac{2}{3}\%$
 21. \$1404.
 22. \$5000.
 23. 187.5.
 24. 11.82.
 25. 963.
 26. \$635.
 27. \$1274.
 28. 9876.
 29. \$3125.
 30. 66 gal.

Page 190

2. \$6.30.
 3. \$4.20.
 4. \$2.16.
 5. \$10.13.
 6. \$22.40.
 7. \$36.55.
 8. \$20.40.
 9. \$22.80.

Page 191

3. 4 mo.
 4. \$3; \$153.
 6. \$208.33.
 7. \$15.40.
 8. \$467.95.
 10. \$142.88.
 11. \$229.50.

Page 192

1. 1896; 1904;
 2000.
 3. 2 yr. 4 mo. 5 da.

4. 2 yr. 2 mo. 3 da.
 5. 5 yr. 10 da.
 6. 4 yr. 7 mo. 21 da.
 7. 2 yr. 2 mo. 13 da.
 8. 6 mo. 9 da.
 9. 1 yr. 6 mo. 12 da.

Page 193

10. \$45.
 11. \$4.39.
 12. \$25.97.
 13. \$61.71.
 14. \$22.34.
 15. \$730.13.
 16. \$652.80.
 17. \$40.69.
 18. \$71.28.
 19. \$1077.38.

Page 196

3. \$1.59.
 4. \$7.95.
 5. \$2.125.
 6. \$20.64+.
 7. \$3.74+.
 8. \$51.64.
 9. \$1.50+.
 10. \$5.57+.
 11. \$1.04+.
 12. \$2.47+.
 13. \$7.17.
 14. \$2.65.
 15. \$.78+.
 16. \$4.04+.
 17. \$47.23+.
 18. \$10.53.
 19. \$11.85.

20. \$38.84.
 21. \$23.08.
 22. \$111.28.
 23. \$52.01+.

Page 198

2. 106 oz.
 3. 47 pt.
 4. 48,240 sec.
 5. 516 sq. in.
 6. 24,860 sec.
 7. 64,350 lb.
 8. 8768 cu. in.
 9. 3 yd. 7 in.
 10. 6 yd. 2 ft. 8 in.
 11. 1 hr. 31 min.
 12. 6 gal. 3 qt.
 13. $28\frac{1}{2}$ lb.
 14. $6\frac{1}{4}$ sq. ft.

Page 199

2. 16 gal. 2 qt.
 3. 38 bu. 1 pk.
 4. 22 yd. 10 in.
 6. 2 gal. 3 qt.
 7. 3 hr. 31 min.
 53 sec.
 8. 1 yd. 2 ft. 9 in.
 13. $7\frac{1}{2}$ in.
 14. 30 lb. 6 oz.
 15. 27 yd. 1 ft. 10 in.
 16. 2 lb. $1\frac{1}{2}$ oz.
 17. $11\frac{1}{2}$.

Page 200

1. $1\frac{1}{2}$; $\frac{1}{2}$.
 2. $1\frac{1}{4}$; $\frac{1}{2}$.
 4. 5280 ft.
 5. 640 rd.; 560 rd.
 6. 160 rd.; 80 rd.;
 40 rd.

7. $\frac{1}{2}$ mi.; $\frac{1}{2}$ mi.; $\frac{1}{2}$ mi.

8. 50%; 25%.
 9. 120 rd.; 200 rd.
 10. 560 rd.
 11. 1056 ft.; 3960 ft.
 12. $1\frac{1}{8}$.
 13. $1\frac{1}{8}$; $1\frac{1}{8}$.
 14. 198 in.
 15. $1\frac{1}{8}$ rd.
 16. 50%.
 17. 63,360 in.;
 39,600 in.
 18. 71,280 ft. 6 in.
 19. 1237 ft. 6 in.

Page 203

18. $13\frac{1}{2}$ sq. ft.
 19. 540 sq. in.
 20. 24 sq. rd.
 21. 43,560 sq. ft.
 22. 174,240 sq. ft.
 23. 28 sq. rd.
 24. $62\frac{1}{2}$ A.
 25. 160 sq. rd.

Page 204

1. 3600 sq. ft.
 2. \$1200.
 3. 96 sq. yd.
 4. $1\frac{1}{8}$; 10%.
 5. 8940 sq. ft.
 6. 11,520 shingles.
 7. 46+ or 47 bundles.
 8. \$49.94.
 9. $1\frac{2}{3}$ sq. rd.
 10. \$63.
 11. 1458.
 12. 4400.

Page 205

1. 640 A.
 2. 160 A.; 2 mi.
 3. $\frac{1}{2}$ sec.
 4. \$3200.
 5. 40 rd. sq. and
 10 A.
 6. \$288.
 7. 45 bu.
 8. \$1500.
 9. \$16,000.
 10. 4 A.
 11. 6 A.
 12. $50\frac{1}{10}$ A.

Page 206

1. 640 A.;
 23,040 A.
 2. 160 A.
 3. 640 rd.
 4. \$3600.
 5. $\frac{1}{2}$ sec.; 160 A.
 6. $1\frac{1}{8}$ sec.
 7. $\frac{1}{2}$ mi.; 1 mi.
 8. \$720.
 9. \$30,720.
 10. \$1,386,240
 profit.

Page 207

1. 3 ways.
 2. Whole area
 180 sq. rd.
 3. 8×16 ; 128; 48.
 4. 12 sq. rd.
 5. 3 ways.
 7. 74 ft.
 9. 269 sq. ft.
 10. \$72.63.

Page 210

2. 12.
 3. 8 bds.
 4. 12 bd. ft.
 5. 36 bd. ft.
 6. 10 bd. ft.
 7. 15 bd. ft.
 8. $40\frac{1}{2}$ bd. ft.
 9. 25 bd. ft.
 10. 72 bd. ft.
 11. \$48.
 12. \$42.50.
 13. \$189.
 14. \$48.
 15. \$28.50.
 16. \$128.
 17. \$6.72.

Page 211

3. 528 sq. ft.
 4. 528 ft. of L;
 \$10.56.
 12. \$4.80.
 13. \$53.76.
 14. 2400 bd. ft.

Page 214

1. 270 cu. in.
 2. 320 cu. in.
 3. 960 cu. in.
 4. 3 in.
 5. $L = \frac{1}{2}$, $A = \frac{1}{2}$,
 $C = \frac{1}{2}$.
 8. 96 blocks.
 9. 30 cu. ft.
 10. 81 cu. ft.
 11. 27 cu. ft.; 1 cu.
 yd.
 12. $85\frac{1}{2}$ cu. yd.

Page 215

1. $2\frac{1}{2}$ times as large.
2. 8 times 1 cu. yd.
3. $\frac{2}{3}$ cu. yd.
4. $\frac{1}{4}$.
5. $20\frac{1}{2}$ lb.
6. 64 cu. yd.
7. 252 cu. ft.
8. 57.6 bu.
9. 64 lb.
10. 1728 boxes.
11. 6000 lb.
12. 1080 cu. ft.
13. \$75.
14. 256 bu.
15. $73\frac{1}{2}$ loads.
16. $6060\frac{1}{2}$ cu. ft.

Page 217

1. \$207.90.
2. 228 cu. yd. 4 cu. ft.
3. \$136.89.
4. \$383.04.
5. \$47.84.
7. 416 sq. ft.; \$127.11.
8. 8 ft.
9. 704 sq. ft.
10. 4 ft.
11. $403\frac{1}{2}$ sq. ft.

Page 218

3. \$7.
4. \$24.
5. 5 cd.
6. 3 cd.; \$20.25.
7. \$22.50.
8. \$1.50.

Page 224

13. 62426.
14. \$4036.50.
15. 67. \$11.75 rem.
16. \$197.25.
17. 256.63.
18. All for 544.66.
19. \$123.31.
20. $29,590\frac{1}{2}$.
21. .1.

Page 225

1. $82\frac{1}{2}$ lb.
2. $10\frac{1}{2}$ yr.
3. $285\frac{1}{2}$.
4. $2\frac{1}{2}$.
5. \$6.77.
6. \$1.70.
7. 6 breadths 8 yd. long cost \$60.
8. 8 breadths cost \$88.
9. 640 rails.
10. \$672.
11. 88 sq. in.
12. \$3379.50.
13. \$2.93.
14. 13,200 ft.
15. 972 sq. in.
16. $77\frac{1}{2}$ rd.
17. 8424 cu. in.
18. 23,836,032 sq. in.
19. 632 cu. ft.
20. 242 lb.
21. \$236.75.

Page 226

1. \$74.57.
2. 1080 gal.

3. \$19.32.

4. 6 yd.

5. \$8.

6. $14\frac{1}{2}$ yd.

7. \$1739.

8. \$3.52.

9. \$40.

10. \$1256.27.

11. \$73.33.

12. \$119.70.

13. \$26.88.

14. $53\frac{1}{2}$ hr.

15. \$420.

Page 227

1. \$4500.
2. (1) 2560 cu. ft.; (2) $94\frac{1}{2}$.
3. \$13.74.
4. \$28.13.
5. 1008 cu. ft.
6. \$756.
7. \$18.
8. \$81.17.
9. $16\frac{1}{2}\%$.
10. 25%.
11. $33\frac{1}{2}\%$.
12. 32 rd.
13. \$9625.
14. 90 cd.
15. 60 da.; \$97\frac{1}{2}

Page 228

1. $30\frac{1}{2}$.
2. 0.9.
3. $2\frac{7}{8}$.
4. \$0.34.
5. 200.
6. $37\frac{1}{2}\%$.
7. 240 A.
8. 2560 times.

9. 6048 cu. in.

10. 233 oz.

11. 55 yd. $1\frac{1}{2}$ ft.

12. 27 sq. in.

13. \$26.36.

14. \$151.54.

15. \$13.88.

16. \$2.40.

17. \$15.

18. \$136.99.

19. \$0.86.

20. 14 ft.

21. $1\frac{1}{2}$.

22. \$284.06.

Page 229

1. \$21.56.
2. 1120 T.
3. 0.32.
4. \$10.50.
5. 174.
6. \$11.46.
7. \$68.68.
8. \$63.85.
9. 4 breadths cost \$32.50.
10. \$522.04.

Page 230

1. $15\frac{1}{2}$.
2. $\frac{1}{18}$.
3. \$300.
4. \$13.13.
5. { length 1:2.
area 1:4.
vol. 1:8.
6. \$2400 cost; \$2200 selling price.
7. \$155.31.
8. $91\frac{1}{2}\%$.

ANSWERS

9. \$ 3.98.
10. \$ 28.33.
11. \$ 251.20.
12. \$ 2.50 per day.
13. $2\frac{1}{2}$ ft.
14. \$ 19.90.

Page 231

1. \$ 243.19.
2. \$ 5.25.
3. 21 mattresses;
\$ 1.25 left.
4. 285 lb.
5. $141\frac{1}{2}$.
6. 9150 cu. ft.
7. \$ 42.70.
8. \$ 16.38.
9. \$ 30.70.

10. \$ 14.63.
11. \$ 3 per ton.
12. \$ 135.
13. 7.7 in.
14. \$ 228.

Page 232

1. \$ 37.125.
2. \$ 28.6875.
3. \$ 859.
4. $\frac{1}{2}$.
5. $\frac{1}{4}$.
6. $13\frac{1}{8}$.
7. \$ 10 gain.
8. \$ 172.94.
9. \$ 4.13 gain.
10. $6\frac{1}{4}\%$.
11. \$ 169.46.

12. 7138 ft.
- 13.
14. \$ 20.63.
15. \$ 320.

Page 233

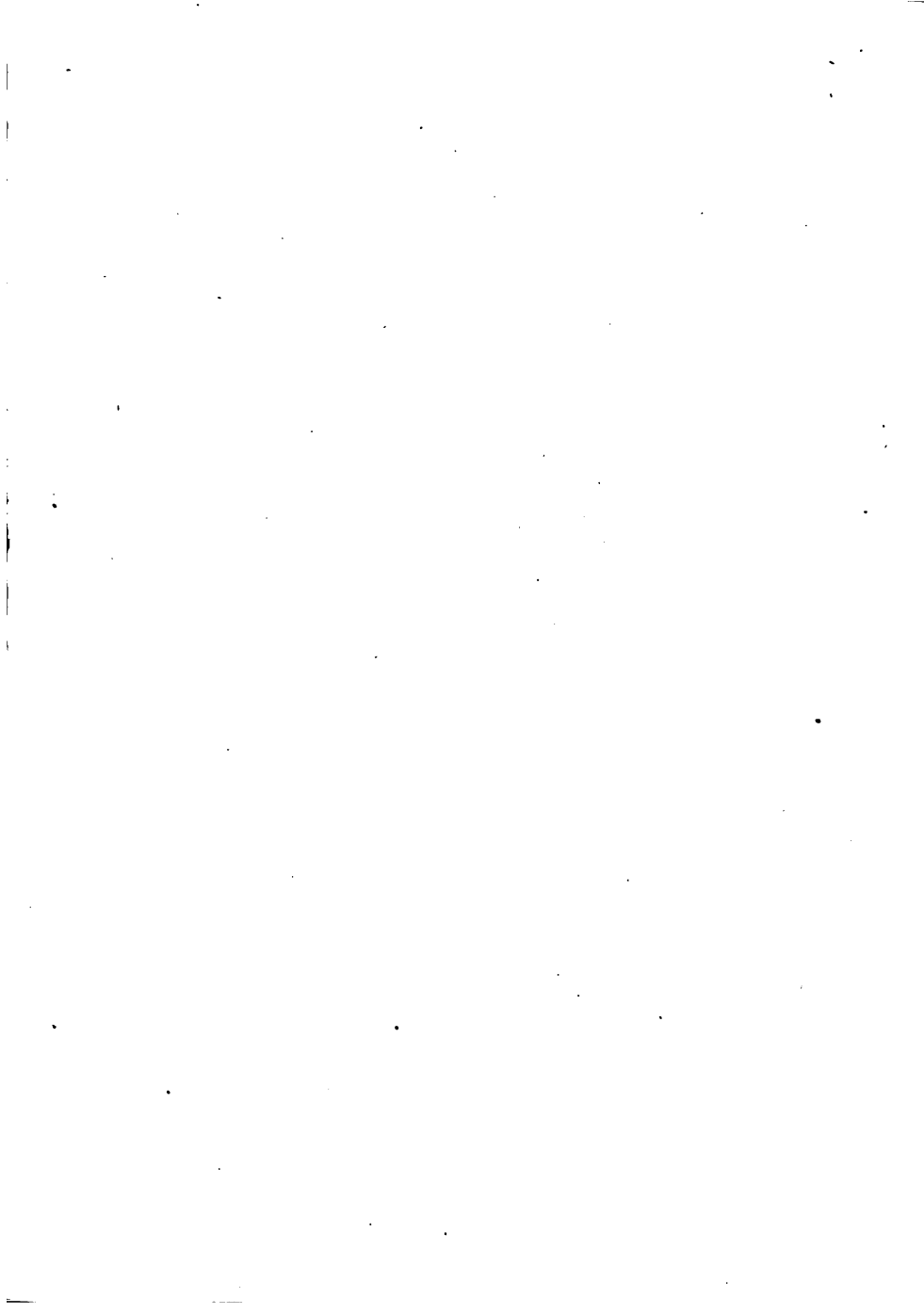
1. $\frac{1}{2}$ or $16\frac{2}{3}\%$.
2. \$ 83.58.
3. 893.02 gal.
4. \$ 684.69.
5. \$ 90.63.
6. 3780 sq. ft.
7. \$ 840.
8. \$ 200.
9. \$ 354.66.
10. \$ 99.99.
11. .0016275.
12. 2 in. wide.

13. \$ 43.6525.
14. \$ 3.50.
15. 61,700 cu. ft.
16. \$ 665.76.

Page 234

1. \$ 480.
2. \$ 2.69.
3. 118 sq. rd.
4. \$ 1.52.
5. 38.09 days.
6. \$ 8.60.
7. \$ 48.75.
8. 40%.
9. 16 tons.
10. 50%.
11. \$ 532.08.
12. \$ 0.08 $\frac{1}{2}$.







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